

AD A063712

DDC FILE COPY

DDC

USARTL-TR-78-23D

**LEVEL III**

A063214 Vol IV, D.



**INTERACTIONAL AERODYNAMICS OF THE SINGLE  
ROTOR HELICOPTER CONFIGURATION**

**VOLUME IV-B - One-Third Octave Band Spectrograms of Wake  
Split-Film Data, Basic Configuration Wake Explorations**

Philip F. Sheridan

Boeing Vertol Company

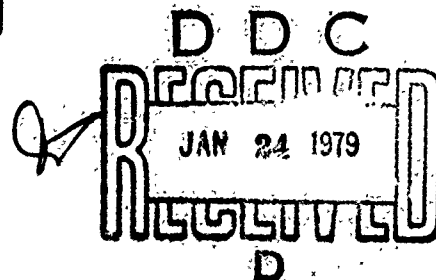
P.O. Box 16858

Philadelphia, Pa. 19142

September 1978

Final Report for Period March 1977 - February 1978

Approved for public release;  
distribution unlimited.



Prepared for

APPLIED TECHNOLOGY LABORATORY

U. S. ARMY RESEARCH AND TECHNOLOGY LABORATORIES (AVRADCOM)

Fort Eustis, Va. 23604

## APPLIED TECHNOLOGY LABORATORY POSITION STATEMENT

In 1975 a wind tunnel test program was conducted in the Boeing-Vertol 20-foot V/STOL Wind Tunnel on a 1/5th-scale UTTAS model to investigate and find solutions for several aerodynamic problems encountered during the UTTAS flight-testing. Specifically, these tests focused upon (a) the structure of the hub/rotor wake in the vicinity of the empennage, (b) the formulation of the ground vortex and its relation to hub loads and fuselage loads during transition, and (c) the occurrence of vibratory air pressures from the blade passing over the fuselage. Only portions of the above-mentioned wind tunnel test data were reduced and analyzed in addressing the flight-test problems of the UTTAS aircraft.

Under Contract DAAJ02-77-C-0020, Boeing-Vertol completed analyses on the data to understand more completely the aerodynamic interactions that are involved and to formulate instructions for the guidance of designers in these respects. The results of these studies are applicable to all existing and future single-rotor/tail rotor helicopters. The data have been segregated according to aerodynamic interactions and associated phenomena/problem areas. From this body of knowledge, a generalized set of design guidelines meaningful to the single-rotor helicopter design concept formulation were developed and are included in these reports.

Mr. Robert P. Smith of the Aeronautical Technology Division, Aeromechanics Technical Area, served as project engineer for this effort.

### DISCLAIMERS

The findings in this report are not to be construed as an official Department of the Army position unless so designated by other authorized documents.

When Government drawings, specifications, or other data are used for any purpose other than in connection with a definitely related Government procurement operation, the United States Government thereby incurs no responsibility nor any obligation whatsoever; and the fact that the Government may have formulated, furnished, or in any way supplied the said drawings, specifications, or other data is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission, to manufacture, use, or sell any patented invention that may in any way be related thereto.

Trade names cited in this report do not constitute an official endorsement or approval of the use of such commercial hardware or software.

### DISPOSITION INSTRUCTIONS

Destroy this report when no longer needed. Do not return it to the originator.

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

| REPORT DOCUMENTATION PAGE   |                       | READ INSTRUCTIONS<br>BEFORE COMPLETING FORM   |  |
|---|-----------------------|---|--|
| 1. REPORT NUMBER<br>USARTL TR-78-23D  | 2. GOVT ACCESSION NO. | 3. RECIPIENT'S CATALOG NUMBER   |  |
| 4. TITLE (and Subtitle)<br>INTERACTIONAL AERODYNAMICS OF THE<br>SINGLE ROTOR HELICOPTER CONFIGURATION,<br>Volume IV, One-Third Octave Band Spectrograms of<br>Wake Split-Film Data, Sub-volume, Basic Con-<br>figuration Wake Explorations.   |                       | 5. TYPE OF REPORT & PERIOD COVERED<br>FINAL REPORT<br>15 Mar 1977 - 13 Feb 1978                 |  |
| 6. AUTHOR(s)<br>Philip F. Sheridan  |                       | 7. PERFORMING ORG. REPORT NUMBER<br>DAAJ02-77-C-0020  |  |
| 8. PERFORMING ORGANIZATION NAME AND ADDRESS<br>Boeing Vertol Company<br>P.O. Box 16858<br>Philadelphia, Pa. 19142   |                       | 9. PROGRAM ELEMENT, PROJECT, TASK<br>AREA & WORK UNIT NUMBER<br>62209A 1L262209AH76<br>00189 EK |  |
| 10. CONTROLLING OFFICE NAME AND ADDRESS<br>Applied Technology Laboratory, U.S. Army<br>Research & Technology Laboratories (AVRADCOM)<br>Fort Eustis, Virginia 23604   |                       | 11. REPORT DATE<br>September 1978   |  |
| 12. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)<br>12334p.  |                       | 13. NUMBER OF PAGES<br>330  |  |
|   |                       | 14. SECURITY CLASS. (of this report)<br>Unclassified  |  |
|   |                       | 15a. DECLASSIFICATION/DOWNGRADING<br>SCHEDULE   |  |
| 16. DISTRIBUTION STATEMENT (of this Report)<br>Approved for public release; distribution unlimited.   |                       |   |  |
| 17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)  |                       |   |  |
| 18. SUPPLEMENTARY NOTES<br>Volume IV of an eight volume report.<br>Volume IV is comprised of seven sub-volumes (A thru G)   |                       |   |  |
| 19. KEY WORDS (Continue on reverse side if necessary and identify by block number)<br>Wake Flow Interaction Aerodynamic Interaction Flow Environment Configuration Empennage Flow Modifier Powered Model  |                       |   |  |
| 20. ABSTRACT (Continue on reverse side if necessary and identify by block number)<br>This is the second of the seven sub-volumes of Volume IV containing one-third octave band spectrograms of the model helicopter hub/rotor wake as it was modified by various aerodynamic devices. This sub-volume deals with wake characteristics of the baseline configurations. |                       |   |  |

403682

70 11 1 1000 1

1/1

# LEVEL III

## PREFACE

The entire report describing the investigation of INTERACTIONAL AERODYNAMICS OF THE SINGLE-ROTOR HELICOPTER CONFIGURATION comprises eight numbered volumes bound as 33 separate documents. The complete list of these documents is as follows:

### Volume I, Final Report

### Volume II, Harmonic Analyses of Airframe Surface Pressure Data

- A - Runs 7-14, Forward Section
- B - Runs 7-14, Mid Section
- C - Runs 7-14, Aft Section
- D - Runs 15-22, Forward Section
- E - Runs 15-22, Mid Section
- F - Runs 15-22, Aft Section
- G - Runs 23-33, Forward Section
- H - Runs 23-33, Mid Section
- I - Runs 23-33, Aft Section

### Volume III, Flow Angle and Velocity Wake Profiles in Low-Frequency Band

- A - Basic Investigations and Hubcap Variations
- B - Air Ejector Systems and Other Devices

### Volume IV, One-Third Octave Band Spectrograms of Wake Split-Film Data

- A - Buildup to Baseline
- B - Basic Configuration Wake Explorations
- C - Solid Hubcaps
- D - Open Hubcaps
- E - Air Ejectors
- F - Air Ejectors With Hubcaps; Wings
- G - Fairings and Surface Devices

This volume is

### Volume V, Harmonic Analyses of Hub Wake

### Volume VI, One-Third Octave Band Spectrograms of Wake Single Film Data

- A - Buildup to Baseline
- B - Basic Configuration Wake Exploration
- C - Hubcaps and Air Ejectors

### Volume VII, Frequency Analyses of Wake Split-Film Data

- A - Buildup to Baseline
- B - Basic Configuration Wake Explorations
- C - Solid Hubcaps

|                                |   |
|--------------------------------|---|
| APPROVED BY                    |   |
| BY                             | Write Section <input checked="" type="checkbox"/> |
| DO                             | Copy Section <input type="checkbox"/>             |
| REMARKS                        | <input type="checkbox"/>                          |
| NOTIFICATION                   |   |
| BY                             |   |
| DISTRIBUTION/AVAILABILITY CODE |   |
| Dist.                          | AVAIL. code/SPECIAL                               |
| A                              |   |



- D - Open Hubcaps
- E - Air Ejectors
- F - Air Ejectors With Hubcaps; Wings
- G - Fairings and Surface Devices

Volume VIII, Frequency Analyses of Wake Single Film Data

- A - Buildup to Baseline
- B - Basic Configuration Wake Exploration
- C - Hubcaps and Air Ejectors

## TABLE OF CONTENTS

|   | <u>PAGE</u> |
|---|-------------|
| INTRODUCTION . . . . .  | 6           |
| OUTLINE OF WAKE INVESTIGATIONS (TABLE 1) . . . . .  | 7           |
| LIST OF TEST RUNS (TABLE 2) . . . . .   | 11          |
| INDEX TO RAKE POSITIONS (TABLE 3) . . . . .   | 18          |
| RAKE ORIENTATION DIAGRAM (FIGURE 1) . . . . .   | 24          |
| HOT FILM RAKE LOCATIONS (FIGURE 2-6) . . . . .  | 25          |
| UTTAS 1/4.85 - SCALE MODEL GEOMETRY<br>AND PRESSURE TRANSDUCER LOCATIONS (FIGURE 7) . . . . . | 30          |
| ONE-THIRD OCTAVE BAND IDENTIFICATION (TABLE 4) . . . . .                                      | 31          |
| SPLIT-FILM 1/3 OCTAVE BAND CHARTS . . . . .   | 32          |

## INTRODUCTION

Volume IV presents spectrograms of the flow angles and velocity components for each run and its test points. Specifically, these machine plots show the root mean square value of each wake parameter over discrete frequency intervals one-third of an octave band in width. The octave arrangement is selected to provide 19 spectral increments from 3.9 to 250.0 Hz centerband frequency. A special computer program is employed to derive wake parameters within these bands consistent with corresponding basic spectral functions depicted in Volume VII.

The graphs showing the one-third octave band values are sequenced in the same order as the Outline of Wake Investigations (Table 1). These graphs are distributed among Volumes IV-A through IV-G by the major categories of Table I in the following arrangement:

|             |  |
|-------------|--|
| Volume IV-A | Build-up to Baseline   |
| Volume IV-B | Basic Configuration  |
| Volume IV-C | Effect of Hub Caps Section 1 & 2   |
| Volume IV-D | Effect of Hub Caps Section 3 & 4   |
| Volume IV-E | Effect of Hub Caps Section 5 and<br>Effect of Air Ejectors               |
| Volume IV-F | Air Ejectors with Open Hub Caps and<br>Effect of Wings and Misc. Section |
| Volume IV-G | Effect of Wings and Misc. Sections<br>2 and 3                            |

The Table I outline and other material is included for reference and as a context to the work of each sub-volume. Table 2, the List of Test Runs, arranges the runs in numerical order and gives pertinent text parameters.

The Index of Rake Positions, Table 3, lists the hot film transducer rake positions in the model coordinate system for each run and its test points. The main feature of Table 3 is the indexing of the test point number to the model waterline station and butt line as it varied from run to run. The table groups the runs as they shared the indexing correspondence of point with position. It is emphasized that the runs in a group do not necessarily all share the same number of test points but they do have same correspondence within their respective ranges of test points.

The orientation of the rake is shown pictorially in Figures 1 through 6 for the various test runs. Figure 7 presents a scaled drawing of the model with reference to the three-axis coordinate system. Table 4 lists the center frequency and the upper and lower band limits for each of the numbered one-third octave bands.

| TABLE 1   |                                |         |           |
|---|--------------------------------|---------|-----------|
| OUTLINE OF WAKE INVESTIGATIONS                      |                                |         |           |
| Description   | Configuration Code             | Run No. | Base-line |
| <u>Build-up to Baseline</u>                         |                                |         |           |
| 1. Nacelles removed                                 | $K_{13}+H_1-N$                 | 149     | 150       |
| 2. Blades off, rotating hub                         | $K_{13}-M+H_{1.0}$             | 160     | 156       |
| 3. " " , non-rotating hub                           | $K_{13}-M+H_{1.0}$             | 158     | 156       |
| 4. " " , hub off                                    | $K_{13}-M-H_{1.0}$             | 159     | 156       |
| <u>Basic Configuration</u>                          |                                |         |           |
| 1. <u>Wake Explorations near Empennage</u>          |                                |         |           |
| (a) 15" Long. + traverse at T/R C.L.                | $K_{11}$                       | 111     | ---       |
| (b) 9" Vert. + " above T/R "                        | "                              | 112     | ---       |
| (c) 2" " " in vortex                                | "                              | 113     | ---       |
| (d) 8" " " (continue 112)                           | "                              | 114     | ---       |
| (e) 13" " " behind stab.                            | "                              | 115     | ---       |
| (f) Lateral traverse, left stab.<br>(One T.P. only) | "                              | 116     | ---       |
| (g) Same continued                                  | "                              | 117     | ---       |
| (h) Same continued (One T.P. only)                  | "                              | 118     | ---       |
| (i) Lateral traverse right stab.                    | "                              | 119     | ---       |
| (j) T/R effect on wake                              | $K_{11}+T_2^0$                 | 121     | 115       |
| 2. <u>Climb/Descent Studies</u>                     |                                |         |           |
| (a) Climb 900 FPM                                   | $K_{11}$                       | 135     | ---       |
| (b) Descent 800 FPM                                 | "                              | 136     | ---       |
| <u>Effect Of Hub Caps</u>                           |                                |         |           |
| 1. <u>Solid Caps on Canister</u>                    |                                |         |           |
| (a) 7.6" diam. 2.17" ht. soft Pitch Arms            | $K_{11}-H_{1.0}+H_{1.2}$       | 137     | 136       |
| (b) 7.6" diam. 2.17" ht. stiff Pitch Arms           | $K_{13}+H_{1.2}$               | 153     | 156       |
| (b) 7.6" diam. 2.45" ht. flt. test config.          | $K_{13}+H_{1.2.1}+I_1+E_{1.0}$ | 207     | 188       |

| TABLE 1 (CONTINUED)                               |   |         |           |
|---|---|---------|-----------|
| OUTLINE OF WAKE INVESTIGATIONS                    |   |         |           |
| Description                                       | Configuration Code*                                   | Run No. | Base-line |
| <u>Effect of Hub Caps (Continued)</u>             |   |         |           |
| <u>2. Solid Caps Raised Above Canister</u>        |   |         |           |
| (a) 7.6" diam. 2.45" ht. 70" depth, .55 gap       | H <sub>1.2.2</sub> +I <sub>1</sub> +E <sub>1.0</sub>  | 208     | 188       |
| (b) 10.0" diam. 3.25" ht. 1.55" depth, .50" gap   | H <sub>1.8.1</sub> +I <sub>1</sub> +E <sub>1.0</sub>  | 189     | 188       |
| (c) 10.0" diam. 4.125" ht. 2.05" depth, .875" gap | H <sub>1.8.2</sub> +I <sub>1</sub> +E <sub>1.0</sub>  | 190     | 188       |
| (d) Repeat of 189                                 | " " "   | 210     | 188       |
| <u>3. Open Caps Without Underbody</u>             |   |         |           |
| (a) 10.0" diam. 1.25" gap, blades                 | H <sub>1.0.2</sub> +I <sub>1</sub> +E <sub>1.0</sub>  | 193     | 188/166   |
| (b) " " " gap, no blades                          | H <sub>1.0.1</sub> -M                                 | 166     | 158       |
| (c) " " 2.05" gap, blades                         | H <sub>1.14.1</sub> +I <sub>1</sub> +E <sub>1.0</sub> | 211     | 188       |
| (d) " " 1.75" gap, no blades                      | H <sub>1.0.1</sub> -M                                 | 165     | 158       |
| (e) " " 1.37" gap, blades                         | H <sub>1.0.3</sub> +I <sub>1</sub> +E <sub>1.0</sub>  | 191     | 188       |
| (f) 16" diam. 2.00" gap, blades                   | H <sub>1.7.1</sub>                                    | 168     | 156/167   |
| (g) " " " gap, no blades                          | H <sub>1.7.1</sub> -M                                 | 167     | 158       |
| (h) " " 4.00" gap, blades                         | H <sub>1.7.2</sub>                                    | 169     | 156       |
| <u>4. Open Caps with Underbody</u>                |   |         |           |
| (a) 7.6" diam. 1.25" gap                          | H <sub>1.11.1</sub> +I <sub>2</sub> +E <sub>1.0</sub> | 194     | 188       |
| (b) " " " "                                       | H <sub>1.11.1</sub> +I <sub>2</sub> +E <sub>4.0</sub> | 198     | 188       |
| (c) " " " " center post                           | H <sub>1.11.2</sub> +I <sub>2</sub>                   | 202     | 194       |
| (d) 10.0" diam. .5" gap, no blades                | H <sub>1.5.1</sub> -M                                 | 164     | 158       |
| (e) " " 1.25" gap, no blades                      | H <sub>1.5.2</sub> -M                                 | 161     | 158       |
| (f) " " 2.0" gap, no blades                       | H <sub>1.5.4</sub> -M                                 | 163     | 158       |
| (g) " " 4.0" gap, no blades                       | H <sub>1.5.3</sub> -M                                 | 162     | 158       |
| (h) " " 1.25" gap                                 | H <sub>1.5.2</sub>                                    | 154     | 156/161   |
| *Basic Code is K13.                               |   |         |           |

TABLE 1 (CONTINUED)

## OUTLINE OF WAKE INVESTIGATIONS

| Description   | Configuration Code*                                   | Run No. | Base-line |
|---|---|---------|-----------|
| <u>5. Miscellaneous Hub Covers</u>                      |   |         |           |
| (a) Hub fairing 16" diam.                               | H <sub>1.3</sub>                                      | 151     | 150       |
| (b) Wham-O-Frisbee 10" diam.                            | H <sub>1.9.0</sub> +E <sub>1.2</sub>                  | 182     | 181       |
| (c) Fab. glass Frisbee 16" diam.                        | H <sub>1.9.1</sub> +E <sub>1.2</sub>                  | 183     | 181       |
| <u>Effect of Air Ejectors</u>                           |   |         |           |
| 1. Basic system no blowing                              | H <sub>1.0</sub> +E <sub>1.0</sub>                    | 172     | 156       |
| 2. " " 40 psi   | " "   | 173     | 156/172   |
| 3. " " 150 psi  | " "   | 174     | 156/172   |
| 4. Wide chord shroud 40 psi                             | H <sub>1.0</sub> +E <sub>2.5.1</sub>                  | 175     | 156/173   |
| 5. Wide " " 150 psi                                     | " "   | 176     | 156/174   |
| 6. W/C shroud w. lip 40 psi                             | H <sub>1.0</sub> +E <sub>3.5.2</sub>                  | 184     | 156/173   |
| 7. Same Contoured Parallel 150 psi                      | H <sub>1.0</sub> +E <sub>3.5.4</sub>                  | 187     | 156/174   |
| 8. Bifurcated duct 0 psi                                | H <sub>1.0</sub> +E <sub>5.0</sub>                    | 203     | 156       |
| 9. " " 40 psi   | " "   | 204     | 156/203   |
| 10. " " 150 psi   | " "   | 205     | 156/203   |
| <u>Air Ejectors with Open Hub Caps with Underbodies</u> |   |         |           |
| 1. 7.6" diam. 1.25" gap, 0 psi                          | H <sub>1.11.1</sub> +I <sub>2</sub> +E <sub>1.0</sub> | 194     | 188/172   |
| 2. " " " " 20 psi                                       | " " "   | 195     | 188       |
| 3. " " " " 40 psi                                       | " " "   | 196     | 188/173   |
| 4. " " " " 150 psi                                      | " " "   | 197     | 188/174   |
| 5. " " " " 0 psi  | H <sub>1.11.1</sub> +I <sub>2</sub> +E <sub>4.0</sub> | 198     | 188/194   |
| 6. " " " " 40 psi                                       | " " "   | 199     | 188/196   |
| 7. " " " " 150 psi                                      | " " "   | 200     | 188/196   |
| 8. Same with center post                                | H <sub>1.11.2</sub> +I <sub>2</sub> +E <sub>4.6</sub> | 201     | 188/200   |
| 9. 10.0" diam. 2.0" gap wide ch'd shroud (150 psi)      | H <sub>1.5.4</sub> +E <sub>2.5.1</sub>                | 177     | 156/176   |
| <u>Effect of Wings and Misc.</u>                        |   |         |           |
| 1. Wings  |   |         |           |
| (a) Nacelle-mounted stub wing                           | H <sub>1.0</sub> +W <sub>1.0</sub> +E <sub>1.1</sub>  | 178     | 181       |
| (b) Single slotted flapped wing                         | H <sub>1.0</sub> +W <sub>3.0</sub> +E <sub>1.0</sub>  | 180     | 181       |
| (c) Double slotted flapped wing                         | H <sub>1.0</sub> +W <sub>2.0</sub> +E <sub>1.0</sub>  | 179     | 181       |
| (d) Boom-mounted stub wing                              | H <sub>1.0</sub> +W <sub>4.0</sub>                    | 186     | 156       |
| *Basic Code is K13.                                     |   |         |           |

TABLE 1 (CONTINUED)

## OUTLINE OF WAKE INVESTIGATIONS

| Description                                | Configuration Code*                | Run No. | Base-line |
|--|------------------------------------|---------|-----------|
| 2. Crown Fairings                          |                                    |         |           |
| (a) Flat top behind shaft                  | K <sub>11</sub> +D <sub>1</sub>    | 140     | 138       |
| (b) Round top behind shaft                 | K <sub>11</sub> +D <sub>2</sub>    | 141     | 138       |
| (c) Extended flat top fairing              | H <sub>1</sub> +D <sub>4</sub>     | 170     | 156       |
| (d) Flat top + 16" cap, 4" gap             | H <sub>1</sub> .7.2+D <sub>4</sub> | 171     | 170       |
| (e) Forward fairing/nacelle fairing        | P <sub>1</sub> .0                  | 152     | 156       |
| 3. Surface Devices                         |                                    |         |           |
| (a) Vortex generators                      | K <sub>11</sub> +VG <sub>2.1</sub> | 139     | 138       |
| (b) Guidevane between nacelles             | K <sub>11</sub> +FV <sub>1</sub>   | 142     | 138       |
| (c) Longitudinal strakes                   | H <sub>1</sub> .5.3+S <sub>4</sub> | 155     | 156       |
| (d) 14% porosity spoiler                   | K <sub>11</sub> +X <sub>1</sub>    | 143     | 138       |
| *Basic Code is K13 unless noted otherwise. |                                    |         |           |

TABLE 2  
LIST OF TEST RUNS  
BASIC INVESTIGATIONS OF THE HUB WAKE

| RUN NO. | CONFIGURATION/CONDITION  | V <sub>TUN</sub> KNOTS | RPM MR/TR | DISK LDG. psf | MODEL ANGLES   |              | MR HT. h/d | TAIL ROTOR |
|---------|--|------------------------|-----------|---------------|----------------|--------------|------------|------------|
|         |  |                        |           |               | $\alpha^\circ$ | $\psi^\circ$ |            |            |
| 111     | K <sub>11</sub> /15" Long. wake traverse at TR center line         | 80                     | 1433/0    | 8             | 6.0            | -2.0         | $\infty$   | Off        |
| 112     | " /9" Vert. wake traverse above TR center line                     | "                      | "         | "             | "              | "            | "          | "          |
| 113     | " /2" Vert traverse through MR vortex                              | "                      | "         | "             | "              | "            | "          | "          |
| 114     | " /8" Vert. traverse below TR center line                          | "                      | "         | "             | "              | "            | "          | "          |
| 115     | " /13" Vert. traverse behind stabilizer                            | "                      | "         | "             | "              | "            | "          | "          |
| 116     | " /Lateral traverse - left stabilizer                              | "                      | "         | "             | "              | "            | "          | "          |
| 117     | " /116 continued   | "                      | "         | "             | "              | "            | "          | "          |
| 118     | " /116 continued   | "                      | "         | "             | "              | "            | "          | "          |
| 119     | " /Lateral traverse - right stabilizer                             | "                      | "         | "             | "              | "            | "          | "          |
| 121     | K <sub>11</sub> +T <sub>2</sub> /Effect of tail rotor flow on wake | "                      | 1433/4500 | "             | "              | "            | "          | On         |
| 135     | K <sub>11</sub> /Wake in 900 fpm climb                             | "                      | "         | "             | -6.0           | -4.5         | "          | Off        |
| 136     | " /Wake in 800 fpm descent   | "                      | "         | "             | 6.0            | -2.0         | "          | "          |



TABLE 2 (CONTINUED)  
LIST OF TEST RUNS  
EVALUATION OF WAKE-ALTERING DEVICES

| RUN NO. | CONFIGURATION/CONDITION  | VTUN KNOTS | RPM MR/TR | DISK LDG. psf | MODEL ANGLES   |              | MR HT. h/d | TAIL ROTOR |
|---------|--|------------|-----------|---------------|----------------|--------------|------------|------------|
|         |  |            |           |               | $\alpha^\circ$ | $\psi^\circ$ |            |            |
| 137     | K <sub>11</sub> -H <sub>1.0</sub> +H <sub>1.2</sub> /Effect of 7.6 inch diam. solid hub cap            | 80         | 1433/0    | 8             | 6              | -3.8         | $\infty$   | Off        |
| 138     | K <sub>11</sub> /Repeat of base run  | "          | "         | "             | "              | "            | "          | "          |
| 139     | K <sub>11</sub> +VG2.1/Effect of vortex generators on aft crown  | "          | "         | "             | "              | "            | "          | "          |
| 140     | K <sub>11</sub> +D <sub>1</sub> /Flat-topped "doghouse" fairing on aft crown                           | "          | "         | "             | "              | "            | "          | "          |
| 141     | K <sub>11</sub> +D <sub>2</sub> /Rounded-top fairing   | "          | "         | "             | "              | "            | "          | "          |
| 142     | K <sub>11</sub> +V <sub>1</sub> /Deflection vane on crown between nacelles                             | "          | "         | "             | "              | "            | "          | "          |
| 143     | K <sub>11</sub> +X <sub>1</sub> /Variable porosity spoiler   | "          | "         | "             | "              | "            | "          | "          |
| 149     | K <sub>13</sub> +H <sub>1-N</sub> /Effect of nacelles off also add stiff pitch arms (K <sub>13</sub> ) | 60         | 1075/0    | 4.5           | "              | "            | "          | "          |
| 150     | K <sub>13</sub> +H <sub>1</sub> /60 knot baseline  | "          | "         | "             | "              | "            | "          | "          |
| 151     | K <sub>13</sub> +H <sub>1.3</sub> /16 inch diam. helmet fairing  | "          | "         | "             | "              | "            | "          | "          |
| 152     | K <sub>13</sub> +P <sub>1.0</sub> /Pylon and intake fairings   | 80         | 1433/0    | 8             | "              | "            | "          | "          |
| 153     | K <sub>13</sub> +H <sub>1.2</sub> /Repeat 137 with K <sub>13</sub> pitch arms                          | "          | "         | "             | "              | "            | "          | "          |

| TABLE 2 (CONTINUED)                 |  |                        |           |                           |              |      |            |            |  |  |
|-------------------------------------|--|------------------------|-----------|---------------------------|--------------|------|------------|------------|--|--|
| LIST OF TEST RUNS                   |  |                        |           |                           |              |      |            |            |  |  |
| EVALUATION OF WAKE-ALTERING DEVICES |  |                        |           |                           |              |      |            |            |  |  |
| RUN NO.                             | CONFIGURATION/CONDITION  | V <sub>TUN</sub> KNOTS | RPM MR/TR | DISK LDG. p <sub>sf</sub> | MODEL ANGLES |      | MR HT. h/d | TAIL ROTOR |  |  |
|                                     |  |                        |           |                           | α°           | ψ°   |            |            |  |  |
| 154                                 | K <sub>13</sub> +H <sub>1.5.2/10"</sub> open hub cap, 7" underbody, 1.25" gap                            | 80                     | 1433/0    | 8                         | 6            | -3.8 | ∞          | Off        |  |  |
| 155                                 | K <sub>13</sub> +H <sub>1.5.2</sub> +S <sub>4</sub> /Same as 154 except strakes on aft crown             | "                      | "         | "                         | "            | "    | "          | "          |  |  |
| 156                                 | K <sub>13</sub> +H <sub>1.0</sub> /Baseline with K <sub>13</sub> , i.e., stiff pitch arms                | "                      | "         | "                         | "            | "    | "          | "          |  |  |
| 158                                 | K <sub>13</sub> -M+H <sub>1.0</sub> /Wake studies with blades off, hub not rotating                      | "                      | 0/0       | "                         | "            | "    | "          | "          |  |  |
| 159                                 | K <sub>13</sub> -M-H <sub>1.0</sub> /Wake studies with hub off   | "                      | "         | "                         | "            | "    | "          | "          |  |  |
| 160                                 | K <sub>13</sub> -M+H <sub>1.0</sub> /Same as 158 except hub is rotating                                  | "                      | 1433/0    | "                         | "            | "    | "          | "          |  |  |
| 161                                 | K <sub>13</sub> -M+H <sub>1.5.2</sub> /Repeat of 154 without blades                                      | "                      | 0/0       | "                         | "            | "    | "          | "          |  |  |
| 162                                 | K <sub>13</sub> -M+H <sub>1.5.3</sub> /Same as 161 except 4" gap   | "                      | "         | "                         | "            | "    | "          | "          |  |  |
| 163                                 | K <sub>13</sub> -M+H <sub>1.5.4</sub> /Same as 161 except 2" gap   | "                      | "         | "                         | "            | "    | "          | "          |  |  |
| 164                                 | K <sub>13</sub> -M+H <sub>1.5.1</sub> /Same as 161 except 0.5" gap                                       | "                      | "         | "                         | "            | "    | "          | "          |  |  |
| 165                                 | K <sub>13</sub> -M+H <sub>1.0.1/10"</sub> open hub cap, no underbody, same cap vert. position as Run 154 | "                      | "         | "                         | "            | "    | "          | "          |  |  |
| 166                                 | K <sub>13</sub> -M+H <sub>1.0.2</sub> /Same as 165 with cap lowered by 0.5"                              | "                      | "         | "                         | "            | "    | "          | "          |  |  |

TABLE 2 (CONTINUED)  
LIST OF TEST RUNS  
EVALUATION OF WAKE-ALTERING DEVICES

| RUN NO. | CONFIGURATION/CONDITION   | V <sub>TUN</sub> KNOTS | RPM MR/TR | DISK LDG. psf | MODEL ANGLES |      | MR HT. h/d | TAIL ROTOR |
|---------|---|------------------------|-----------|---------------|--------------|------|------------|------------|
|         |   |                        |           |               | α°           | ψ°   |            |            |
| 167     | K <sub>13</sub> -M+H <sub>1.7.1/16"</sub> open cap, no underbody, 2" gap                                | 80                     | 0/0       | 8             | 6            | -3.8 | ∞          | Off        |
| 168     | K <sub>13</sub> +H <sub>1.7.1/Blades on, same cap config. as 167</sub>                                  | "                      | 1433/0    | "             | "            | "    | "          | "          |
| 169     | K <sub>13</sub> +H <sub>1.7.2/16"</sub> open cap, no underbody, 4" gap                                  | "                      | "         | "             | "            | "    | "          | "          |
| 170     | K <sub>13</sub> +H <sub>1.0</sub> +D <sub>4.0</sub> /Extended flat top fairing on aft crown             | "                      | "         | "             | "            | "    | "          | "          |
| 171     | K <sub>13</sub> +E <sub>1.7.2</sub> +D <sub>4.0</sub> /Same fairing as 170, same cap as 169             | "                      | "         | "             | "            | "    | "          | "          |
| 172     | K <sub>13</sub> +H <sub>1.0</sub> +E <sub>1.0</sub> (0psi)/Basic air ejector zero blowing baseline      | "                      | "         | "             | "            | "    | "          | "          |
| 173     | K <sub>13</sub> +H <sub>1.0</sub> +E <sub>1.0</sub> (40 psi)/Same as 172 with 40 psi supply             | "                      | "         | "             | "            | "    | "          | "          |
| 174     | K <sub>13</sub> +H <sub>1.0</sub> +E <sub>1.0</sub> (150 psi)/Same as 172 with 150 psi supply           | "                      | "         | "             | "            | "    | "          | "          |
| 175     | K <sub>13</sub> +H <sub>1.0</sub> +E <sub>2.5.1</sub> (40 psi)/Ejector with wide chord shroud at 40 psi | "                      | "         | "             | "            | "    | "          | "          |
| 176     | K <sub>13</sub> +H <sub>1.0</sub> +E <sub>2.5.1</sub> (150 psi)/Same as 174 with 150 psi supply         | "                      | "         | "             | "            | "    | "          | "          |
| 177     | K <sub>13</sub> +H <sub>1.5</sub> +E <sub>2.5.1</sub> (150 psi)/Same as 176 with 10" cap like 163       | "                      | "         | "             | "            | "    | "          | "          |
| 178     | K <sub>13</sub> +H <sub>1.0</sub> +W <sub>1.0</sub> +E <sub>1.1</sub> (0 psi)/Nacelle mounted wing      | "                      | "         | "             | "            | "    | "          | "          |

TABLE 2 (CONTINUED)  
LIST OF TEST RUNS

EVALUATION OF WAKE-ALTERING DEVICES

| RUN NO. | CONFIGURATION/CONDITION   | VTUN KNOTS | RPM MR/TR | DISK LDG. psf | MODEL ANGLES   |              | MR HT. h/d | TAIL ROTOR |
|---------|---|------------|-----------|---------------|----------------|--------------|------------|------------|
|         |   |            |           |               | $\alpha^\circ$ | $\psi^\circ$ |            |            |
| 179     | K13+H1.0+W2.0+E1.0 (0 psi)/Double slotted flapped wing            | 80         | 1433/0    | 8             | 6              | -3.8         | $\infty$   | Off        |
| 180     | K13+H1.0+W3.0+E1.0 (0 psi)/Single slotted flapped wing            | "          | "         | "             | "              | "            | "          | "          |
| 181     | K13+H1.0+E1.2 (0 psi)/Baseline with ejector tube moved aft        | "          | "         | "             | "              | "            | "          | "          |
| 182     | K13+H1.9.0+E1.2 (0 psi)/Standard 10" frisbee                      | "          | "         | "             | "              | "            | "          | "          |
| 183     | K13+H1.9.1+E1.2 (0 psi)/16" fabricated frisbee                    | "          | "         | "             | "              | "            | "          | "          |
| 184     | K13+H1.0+E3.5.2 (40 psi)/Wide chord with lip at 40 psi            | "          | "         | "             | "              | "            | "          | "          |
| 185     | K13+H1.0+E3.5.2 (150 psi)/Same as 184 with 150 psi air            | "          | "         | "             | "              | "            | "          | "          |
| 186     | K13+H1.0+W4.0/Boom mounted stub wing                              | "          | "         | "             | "              | "            | "          | "          |
| 187     | K13+H1.0+E2.5.4 (150 psi)/Like 185 with modified shroud           | "          | "         | "             | "              | "            | "          | "          |
| 188     | K13+H1.0+I1+E1.0 (0 psi)/Baseline with I <sub>1</sub> instr. ring | "          | "         | "             | "              | "            | "          | "          |
| 189     | K13+H1.8.1+I1+E1.0 (0 psi)/Solid cap, 10" diam. 3.25" height      | "          | "         | "             | "              | "            | "          | "          |
| 190     | K13+H1.8.2+I1+E1.0 (0 psi)/Same as 190 except + 4.12" height      | "          | "         | "             | "              | "            | "          | "          |

TABLE 2 (CONTINUED)  
LIST OF TEST RUNS  
EVALUATION OF WAKE-ALTERING DEVICES

| RUN NO. | CONFIGURATION/CONDITION   | VTUN KNOTS | RPM MR/TR | DISK LDG. psf | MODEL ANGLES   |              | MR HT. h/d | TAIL ROTOR |
|---------|---|------------|-----------|---------------|----------------|--------------|------------|------------|
|         |   |            |           |               | $\alpha^\circ$ | $\psi^\circ$ |            |            |
| 191     | K13+H1.0.2+I1+E1.0 (0 psi)/10" cap, no underbody, 1.87" gap         | 80         | 1433/0    | 8             | 6              | -3.8         | $\infty$   | Off        |
| 193     | K13+H1.0.2+I1+E1.0 (0 psi)/10" cap, no underbody, 1.25" gap         | "          | "         | "             | "              | "            | "          | "          |
| 194     | K13+H1.11.1+I2+E1.0 (0 psi)/7.6" cap, underbody, 1.25" gap          | "          | "         | "             | "              | "            | "          | "          |
| 195     | K13+H1.11.1+I2+E1.0 (20 psi)/Same as 194 with 20 psi air            | "          | "         | "             | "              | "            | "          | "          |
| 196     | K13+H1.11.1+I2+E1.0 (40 psi)/Same as 194 with 40 psi air            | "          | "         | "             | "              | "            | "          | "          |
| 197     | K13+H1.11.1+I2+E1.0 (150 psi)/Same as 194 with 150 psi air          | "          | "         | "             | "              | "            | "          | "          |
| 198     | K13+H1.11.1+I2+E4.0 (0 psi)/Same as 194 except blowing tube 2" aft  | "          | "         | "             | "              | "            | "          | "          |
| 199     | K13+H1.11.1+I2+E4.0 (40 psi)/Same as 198 with 40 psi air            | "          | "         | "             | "              | "            | "          | "          |
| 200     | K13+H1.11.1+I2+E4.0 (150 psi)/Same as 198 with 150 psi air          | "          | "         | "             | "              | "            | "          | "          |
| 201     | K13+H1.11.2+I2+E4.0 (150 psi)/Same as 200 except center support cap | "          | "         | "             | "              | "            | "          | "          |
| 202     | K13+H1.11.2+I2/Baseline with I2 and no blowing tube                 | "          | "         | "             | "              | "            | "          | "          |
| 203     | K13+H1.0+E5.0 (0 psi)/Bifurcated air duct baseline                  | "          | "         | "             | "              | "            | "          | "          |

TABLE 2 (CONTINUED)  
LIST OF TEST RUNS  
EVALUATION OF WAKE-ALTERING DEVICES

| RUN NO. | CONFIGURATION/CONDITION   | VTUN KNOTS | RPM MR/TR | DISK LDG. psf | MODEL ANGLES   |              | MR HT. h/d | TAIL ROTOR |
|---------|---|------------|-----------|---------------|----------------|--------------|------------|------------|
|         |   |            |           |               | $\alpha^\circ$ | $\psi^\circ$ |            |            |
| 204     | K13+H1.0+E5.0 (150 psi)/Bifurcated duct with 150 psi air        | 80         | 1433/0    | 8             | 6              | -3.8         | $\infty$   | Off        |
| 205     | K13+H1.0+E5.0 (40 psi)/Same as 204 with 40 psi air              | "          | "         | "             | "              | "            | "          | "          |
| 207     | K13+H1.2.1+I1+E1.0 (0 psi)/7.6" solid cap, no gap               | "          | "         | "             | "              | "            | "          | "          |
| 208     | K13+H1.2.2+I1+E1.0 (0 psi)/Same as 207 except 0.55" gap         | "          | "         | "             | "              | "            | "          | "          |
| 210     | K13+H1.15.1+I1+E1.0 (0 psi)/Repeat of 189                       | "          | "         | "             | "              | "            | "          | "          |
| 211     | K13+H1.14.1+I1+E1.0 (0 psi)/Like 189 and 210 except cap is open | "          | "         | "             | "              | "            | "          | "          |
|         |   |            |           |               |                |              |            |            |
|         |   |            |           |               |                |              |            |            |
|         |   |            |           |               |                |              |            |            |
|         |   |            |           |               |                |              |            |            |
|         |   |            |           |               |                |              |            |            |
|         |   |            |           |               |                |              |            |            |
|         |   |            |           |               |                |              |            |            |
|         |   |            |           |               |                |              |            |            |

TABLE 3

## INDEX TO RAKE POSITIONS

| RUN<br>NUMBER | TEST<br>POINT | WATER<br>LINE | MODEL<br>STATION | BUTT<br>LINE | LOCATION<br>FIGURE |
|---------------|---------------|---------------|------------------|--------------|--------------------|
| 111           | 20            | 53.5          | 103.1            | -7.25        | 1                  |
|               | 21            | "             | "                | "            |                    |
|               | 22            | "             | 105.0            | "            |                    |
|               | 24            | "             | 107.0            | "            |                    |
|               | 26            | "             | 109.0            | "            |                    |
|               | 28            | "             | 111.0            | "            |                    |
|               | 30            | "             | 112.9            | "            |                    |
|               | 32            | "             | 114.9            | "            |                    |
|               | 34            | "             | 116.9            | "            |                    |
|               | 36            | "             | 118.9            | "            |                    |
| 112           | 2             | 48.9          | 107.3            | -7.25        | 1                  |
|               | 4             | 50.8          | "                | "            |                    |
|               | 6             | 52.7          | 103.3            | "            |                    |
|               | 8             | 54.5          | "                | "            |                    |
|               | 10            | 56.2          | "                | "            |                    |
|               | 12            | 57.2          | "                | "            |                    |
| 113           | 2             | 51.7          | 103.3            | -3.25        | 1                  |
|               | 4             | 52.3          | "                | "            |                    |
|               | 6             | 52.8          | "                | "            |                    |
|               | 8             | 53.3          | "                | "            |                    |
|               | 10            | 53.9          | "                | "            |                    |
|               | 11            | 53.3          | "                | "            |                    |
| 114           | 2             | 44.5          | 103.0            | -3.25        | 1                  |
|               | 4             | 46.4          | "                | "            |                    |
|               | 6             | 48.2          | "                | "            |                    |
|               | 8             | 50.0          | "                | "            |                    |
|               | 10            | 51.9          | "                | "            |                    |
| 115           | 3             | 52.9          | 124.7            | -3.25        | 1                  |
|               | 4             | 52.0          | "                | "            |                    |
|               | 6             | 50.0          | "                | "            |                    |
|               | 9             | 48.0          | "                | "            |                    |
|               | 10            | 46.0          | "                | "            |                    |
|               | 12            | 44.1          | "                | "            |                    |
|               | 14            | 42.1          | "                | "            |                    |
|               | 16            | 53.0          | "                | "            |                    |
|               | 18            | 54.0          | "                | "            |                    |
|               | 20            | 55.0          | "                | "            |                    |

TABLE 3 (CONTINUED)  
INDEX TO RAKE POSITIONS

| RUN<br>NUMBER | TEST<br>POINT  | WATER<br>LINE  | MODEL<br>STATION                                   | BUTT<br>LINE                                       | LOCATION<br>FIGURE |
|---------------|--|--|--|--|--------------------|
| 116           | 7  | 36.9   | 100.5  | -17.5  | 1                  |
| 117           | 2<br>4<br>6<br>8<br>10                               | 37.6<br>"<br>37.3<br>"<br>"  | 100.5<br>"<br>99.6<br>"<br>"                       | -16.0<br>-14.0<br>-12.0<br>-10.0<br>- 8.0          | 1                  |
| 118           | 2  | 37.6   | 100.5  | - 6.0  | 1                  |
| 119           | 2<br>5<br>8<br>9<br>14<br>16<br>20<br>25             | 37.3<br>"<br>"<br>"<br>"<br>"<br>51.5<br>52.3                                | 99.6<br>"<br>"<br>"<br>"<br>"<br>102.5<br>101.7    | + 6.0<br>8<br>10<br>"<br>14<br>16<br>17.5<br>-17.5 | 1                  |
| 121           | 3<br>4<br>6<br>8<br>10                               | 62.9<br>53.5<br>50.1<br>46.0<br>42.1   | 129.0<br>"<br>"<br>"<br>"                          | + 5.7<br>"<br>"<br>"<br>"                          | 2                  |
| 135           | 2<br>4<br>6<br>8<br>10<br>12<br>14                   | 56.9<br>54.5<br>52.5<br>50.5<br>48.5<br>46.5<br>44.5                         | 106.3<br>"<br>"<br>"<br>"<br>"<br>"                | - 5.7<br>"<br>"<br>"<br>"<br>"<br>"                | 3                  |
| 136           | 2<br>4<br>6<br>8<br>10<br>12<br>14<br>17<br>18<br>19 | 56.5<br>54.5<br>52.5<br>50.6<br>48.5<br>46.5<br>44.5<br>37.1<br>39.0<br>41.0 | 104.0<br>"<br>"<br>"<br>"<br>"<br>"<br>"<br>"<br>" | - 8.0<br>"<br>"<br>"<br>"<br>"<br>"<br>"<br>"<br>" | 4                  |



| TABLE 3 (CONTINUED)     |               |               |                  |              |                    |
|-------------------------|---------------|---------------|------------------|--------------|--------------------|
| INDEX TO RAKE POSITIONS |               |               |                  |              |                    |
| RUN<br>NUMBER           | TEST<br>POINT | WATER<br>LINE | MODEL<br>STATION | BUTT<br>LINE | LOCATION<br>FIGURE |
| 137                     | 3             | 38.7          | 98.4             | - 9.0        | 5                  |
|                         | 5             | 39.9          | "                | "            |                    |
|                         | 7             | 42.0          | 100.5            | "            |                    |
|                         | 9             | 44.0          | "                | "            |                    |
|                         | 11            | 46.0          | 103.6            | "            |                    |
|                         | 13            | 48.0          | "                | "            |                    |
|                         | 15            | 50.0          | "                | "            |                    |
|                         | 17            | 52.0          | "                | "            |                    |
|                         | 19            | 54.0          | "                | "            |                    |
| 138-41, 143             | 2             | 38.8          | 98.4             | - 8.0        | 5                  |
|                         | 3             | 40.0          | "                | "            |                    |
|                         | 4             | 42.0          | 100.5            | "            |                    |
|                         | 5             | 44.0          | "                | "            |                    |
|                         | 6             | 46.0          | 103.6            | "            |                    |
|                         | 7             | 48.0          | "                | "            |                    |
|                         | 8             | 50.0          | "                | "            |                    |
|                         | 9             | 52.0          | "                | "            |                    |
|                         | 10            | 54.0          | "                | "            |                    |
| 142                     | 7             | 37.8          | 98.4             | - 8.0        | 5                  |
|                         | 8             | "             | "                | "            |                    |
|                         | 9             | 40.2          | "                | "            |                    |
|                         | 10            | 42.0          | 100.5            | "            |                    |
|                         | 11            | 44.0          | "                | "            |                    |
|                         | 12            | 46.0          | 103.6            | "            |                    |
|                         | 13            | 48.0          | "                | "            |                    |
|                         | 14            | 50.0          | "                | "            |                    |
|                         | 15            | 52.0          | "                | "            |                    |
|                         | 16            | 54.0          | "                | "            |                    |
|                         | 17            | 56.8          | "                | "            |                    |
|                         |               |               |                  |              |                    |

TABLE 3 (CONTINUED)  
INDEX TO RAKE POSITIONS

| RUN<br>NUMBER | TEST<br>POINT | WATER<br>LINE | MODEL<br>STATION | BUTT<br>LINE | LOCATION<br>FIGURE |
|---------------|---------------|---------------|------------------|--------------|--------------------|
| 149-151       | 2             | 38.8          | 98.5             | - 8.0        | 5                  |
|               | 3             | 40.0          | "                | "            |                    |
|               | 4             | 42.0          | 100.6            | "            |                    |
|               | 5             | 44.0          | "                | "            |                    |
|               | 6             | 46.0          | 103.5            | "            |                    |
|               | 7             | 48.0          | "                | "            |                    |
|               | 8             | 50.0          | "                | "            |                    |
|               | 9             | 52.0          | "                | "            |                    |
|               | 10            | 54.0          | "                | "            |                    |
|               |               |               |                  |              |                    |
| 152-6, 158    | 2             | 42.9          | 97.9             | 0.0          | 6                  |
| 161-4, 166    | 3             | 44.9          | "                | "            |                    |
| 167, 169-71   | 4             | 46.9          | 100.6            | "            |                    |
| 175, 177-9    | 5             | 48.9          | "                | "            |                    |
| 180, 182, 184 | 6             | 50.9          | 104.6            | "            |                    |
| 186-8, 190    | 7             | 52.9          | "                | "            |                    |
| 191, 193, 194 | 8             | 54.9          | "                | "            |                    |
| 196, 198, 201 | 9             | 56.9          | "                | "            |                    |
| 204, 207, 208 |               |               |                  |              |                    |
| 211           |               |               |                  |              |                    |
| 159           | 1             | 54.9          | 104.6            | 0.0          | 6                  |
|               | 2             | 52.9          | "                | "            |                    |
|               | 3             | 50.7          | "                | "            |                    |
|               | 4             | 48.6          | 100.6            | "            |                    |
|               | 5             | 46.7          | "                | "            |                    |
| 160, 203      | 5             | 42.9          | 97.9             | 0.0          | 6                  |
|               | 6             | 44.9          | "                | "            |                    |
|               | 7             | 46.9          | 100.6            | "            |                    |
|               | 8             | 48.9          | "                | "            |                    |
|               | 9             | 50.9          | 104.6            | "            |                    |
|               | 10            | 52.9          | "                | "            |                    |
|               | 11            | 54.9          | "                | "            |                    |
| 165           | 3             | 44.9          | 97.9             | 0.0          | 6                  |
|               | 4             | 42.9          | "                | "            |                    |
|               | 5             | 46.9          | 100.6            | "            |                    |
|               | 6             | 48.9          | "                | "            |                    |
|               | 7             | 50.9          | 104.6            | "            |                    |
|               | 8             | 52.9          | "                | "            |                    |

| TABLE 3 (CONTINUED)                              |               |               |                  |              |                    |
|--|---------------|---------------|------------------|--------------|--------------------|
| INDEX TO RAKE POSITIONS                          |               |               |                  |              |                    |
| RUN<br>NUMBER                                    | TEST<br>POINT | WATER<br>LINE | MODEL<br>STATION | BUTT<br>LINE | LOCATION<br>FIGURE |
| 168, 183   | 4             | 42.9          | 97.9             | 0.0          | 6                  |
|  | 5             | 44.9          | "                | "            |                    |
|  | 6             | 46.9          | 100.6            | "            |                    |
|  | 7             | 48.9          | "                | "            |                    |
|  | 8             | 50.9          | 104.6            | "            |                    |
|  | 9             | 52.9          | "                | "            |                    |
|  | 10            | 54.9          | "                | "            |                    |
| 172  | 3             | 42.9          | 97.9             | 0.0          | 6                  |
|  | 4             | 44.9          | "                | "            |                    |
|  | 6             | 44.9          | "                | "            |                    |
|  | 7             | 46.9          | 100.6            | "            |                    |
|  | 8             | 48.9          | "                | "            |                    |
|  | 9             | 50.9          | 104.6            | "            |                    |
|  | 10            | 52.9          | "                | "            |                    |
| 173,174,176<br>185,195,197<br>199,200,205<br>210 | 11            | 54.9          | "                | "            |                    |
|  | 1             | 42.9          | 97.9             | 0.0          | 6                  |
|  | 2             | 44.9          | "                | "            |                    |
|  | 3             | 46.9          | 100.6            | "            |                    |
|  | 4             | 48.9          | "                | "            |                    |
|  | 5             | 50.9          | 104.6            | "            |                    |
|  | 6             | 52.9          | "                | "            |                    |
| 181  | 7             | 54.9          | "                | "            |                    |
|  | 2             | 42.9          | 97.9             | 0.0          | 6                  |
|  | 3             | 44.9          | "                | "            |                    |
|  | 4             | 46.9          | 100.6            | "            |                    |
|  | 5             | 48.9          | "                | "            |                    |
|  | 6             | 50.9          | 104.6            | "            |                    |
|  | 7             | 52.9          | "                | "            |                    |
|  | 9             | 54.9          | "                | "            |                    |
|  | 10            | "             | "                | "            |                    |
|  | 11            | "             | "                | "            |                    |
|  | 12            | "             | "                | "            |                    |
|  | 13            | 42.9          | 97.9             | "            |                    |
|  |               |               |                  |              |                    |

[illegible]



RUN 121

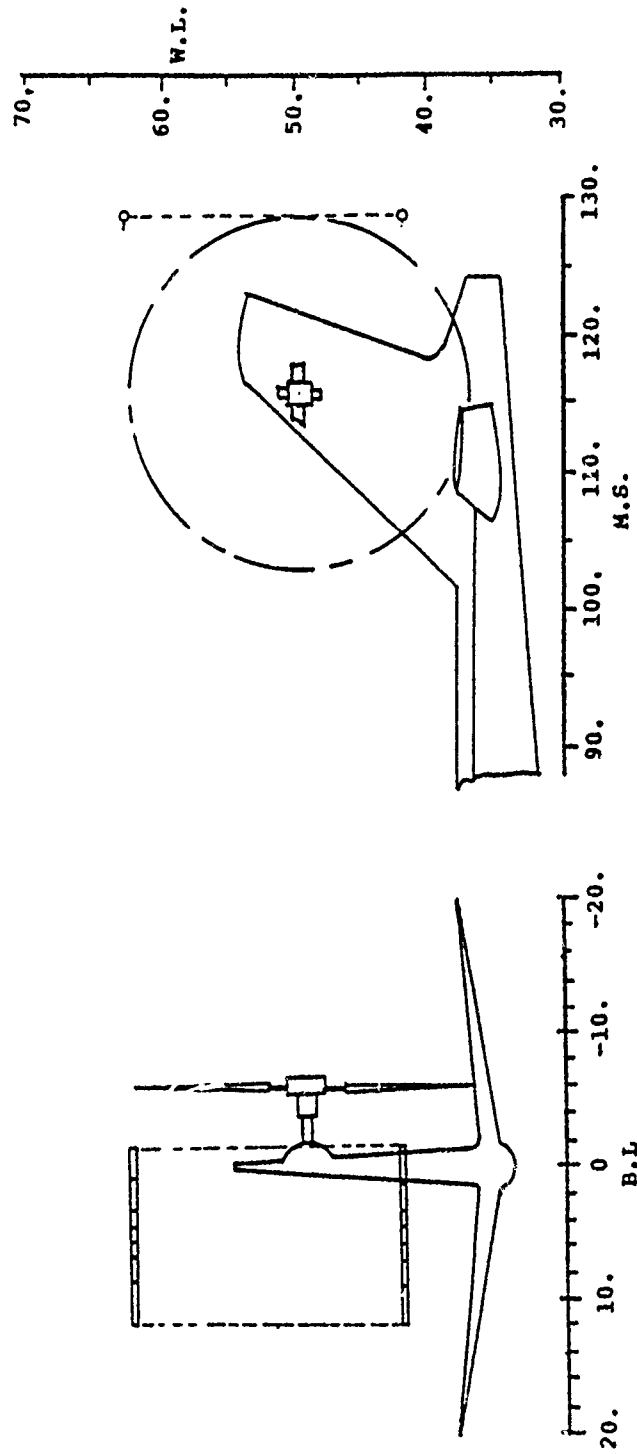


FIGURE 2 -HOT FILM RAKE LOCATIONS

RUN 135

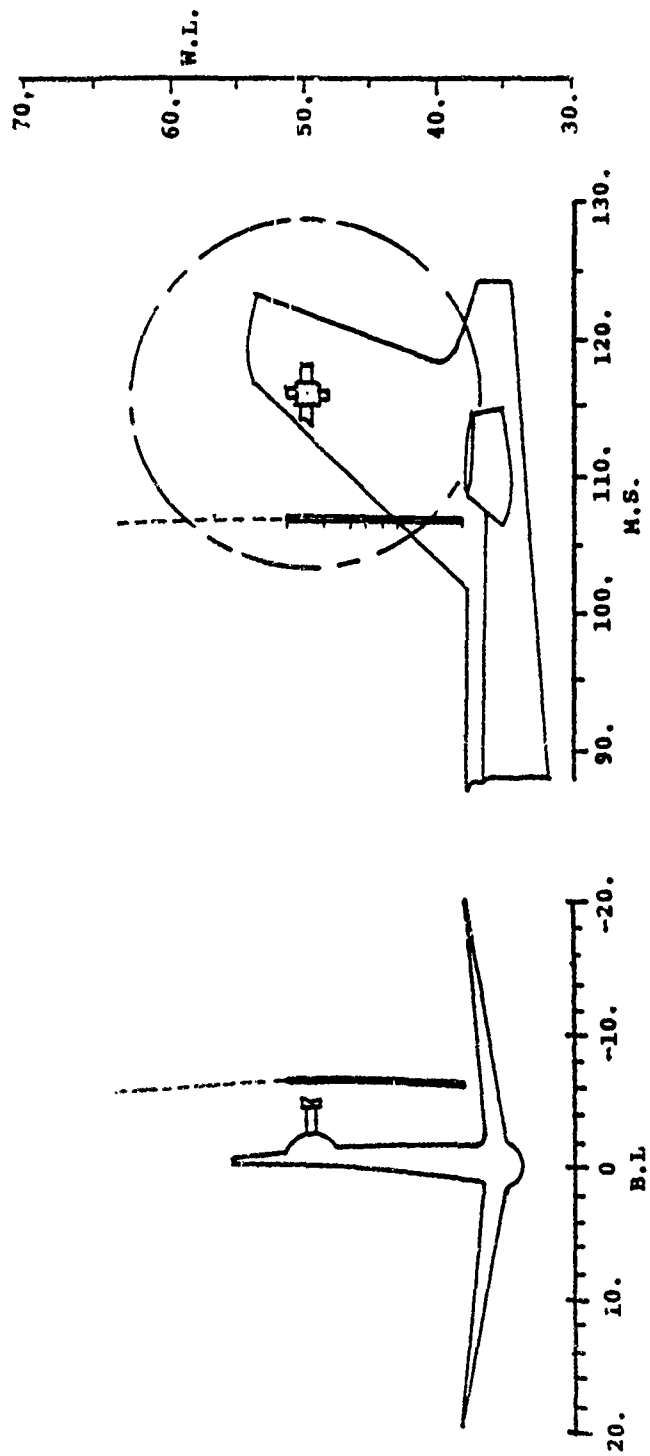


FIGURE 3 -HOT FILM RAKE LOCATIONS

RUN 136

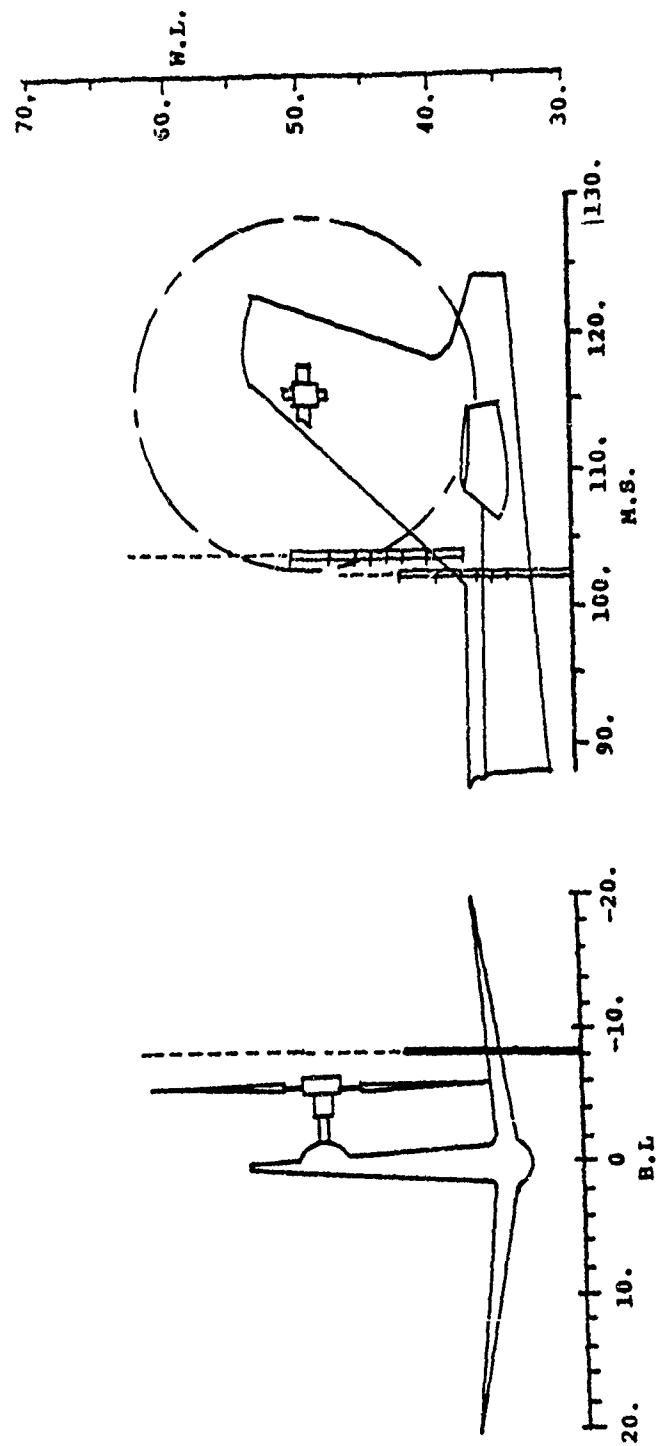


FIGURE 4 -HOT FILM RAKE LOCATIONS



RUN 137, 138, 139, 140, 141, 142,  
143, 148, 149, 150, 151

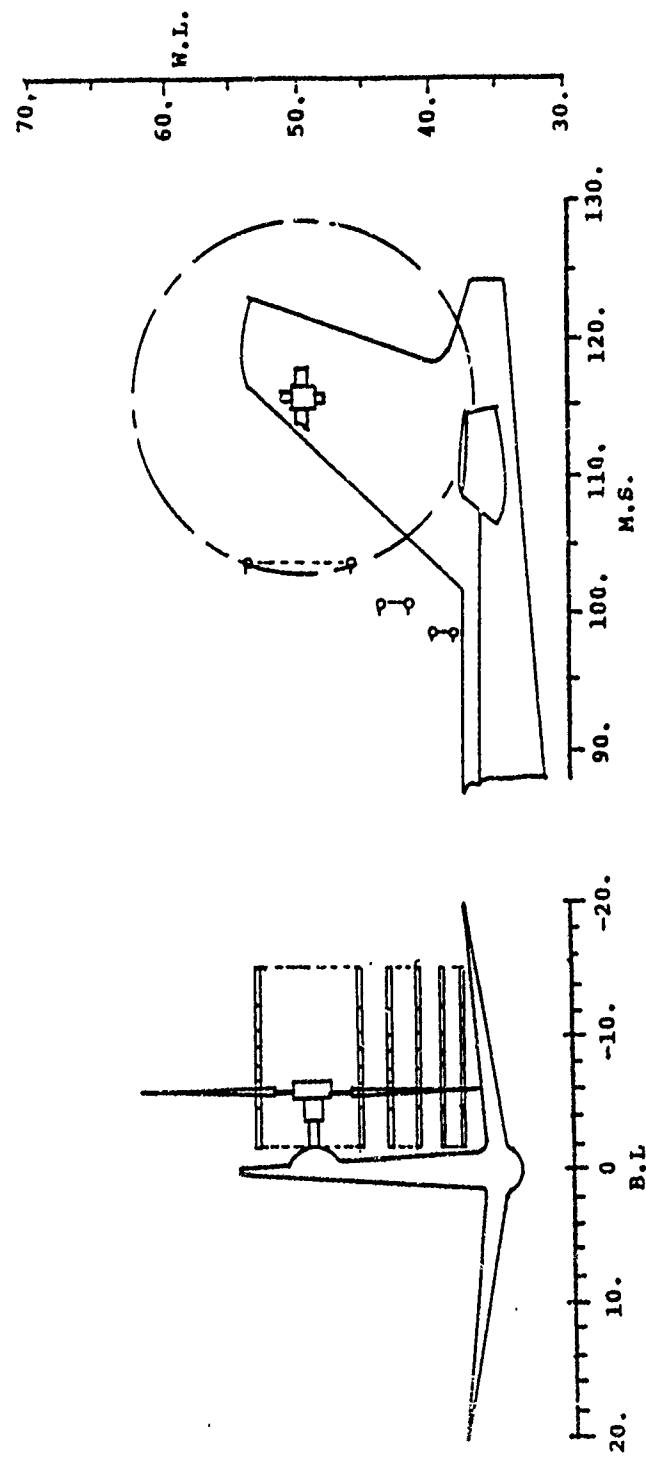


FIGURE 5 -HOT FILM RAKE LOCATIONS

RUN 152-156, 158-211

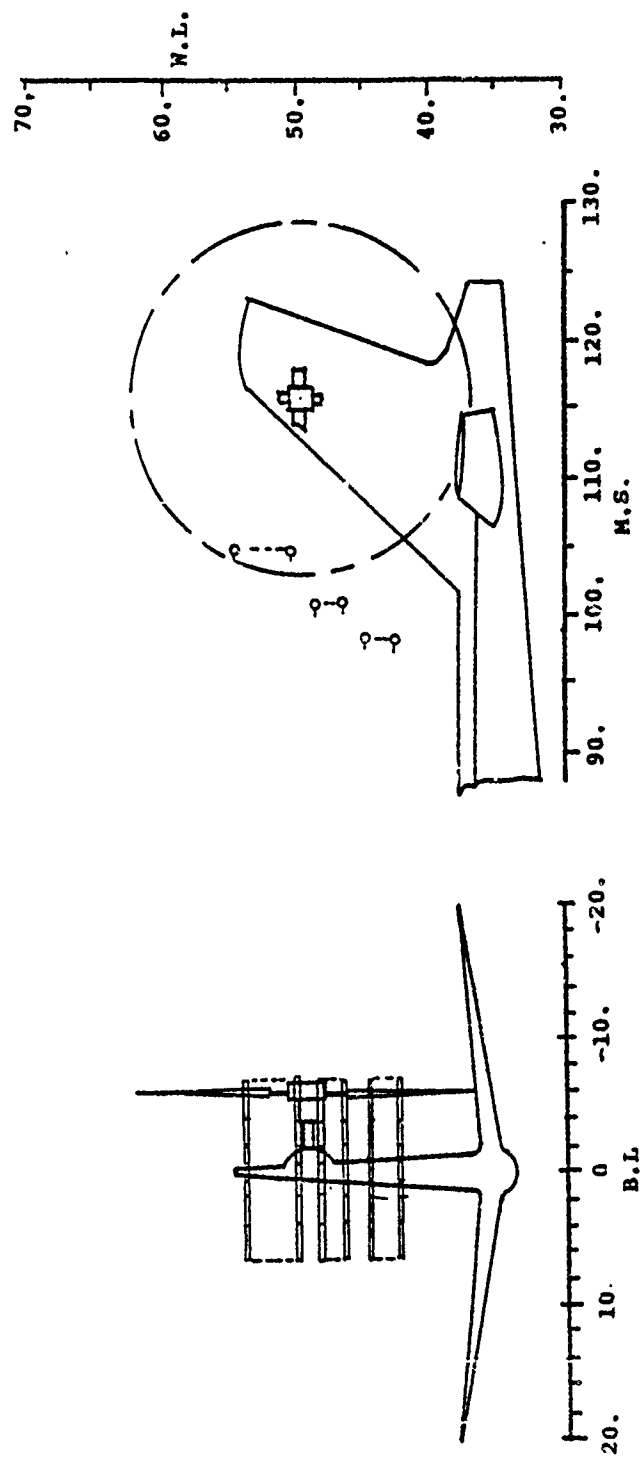


FIGURE 6 --HOT FILM RAKE LOCATIONS

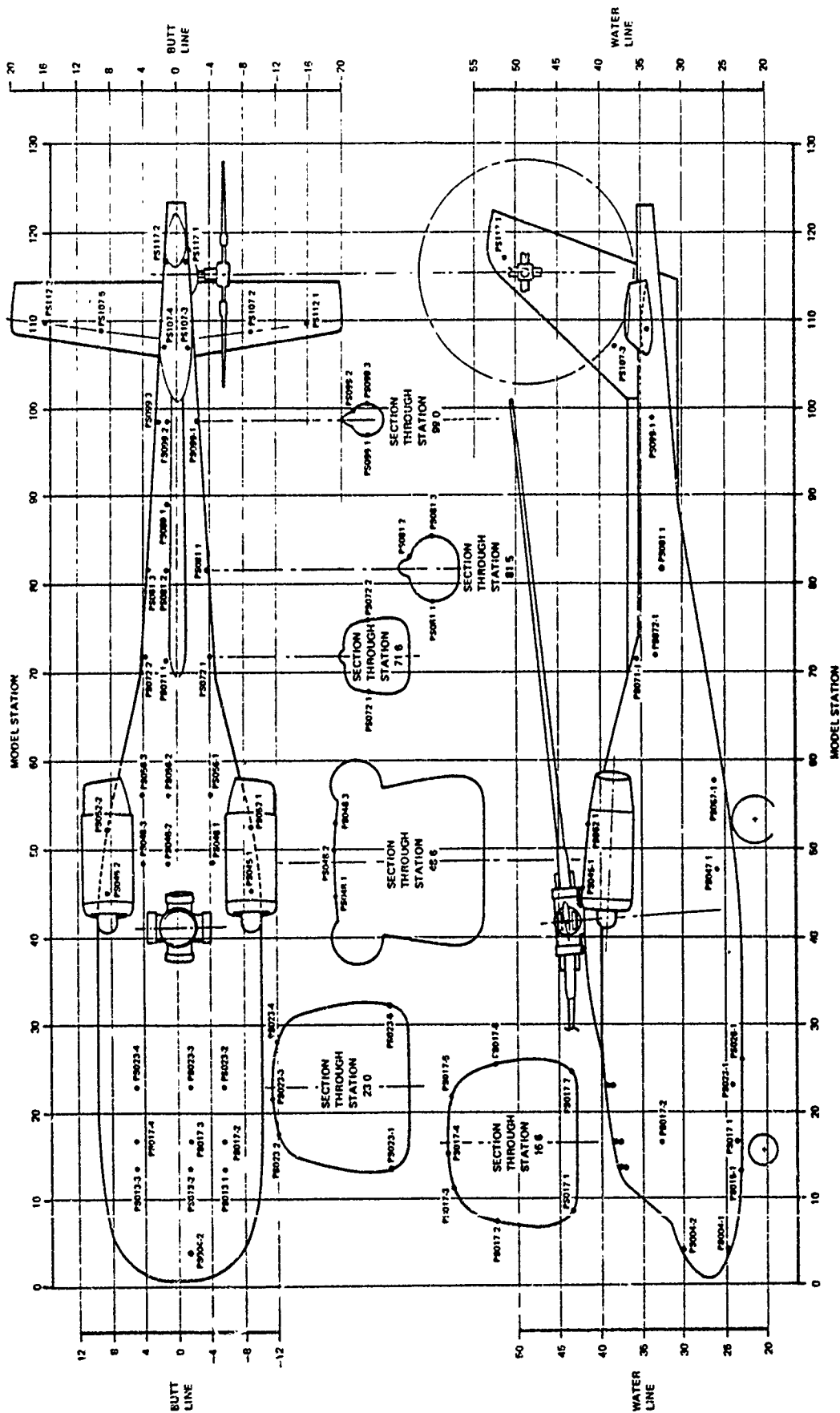


FIGURE 7 -1/4.85 SCALE MODEL GEOMETRY AND  
SURFACE PRESSURE TRANSDUCER LOCATIONS

TABLE 4  
1/3 OCTAVE BAND IDENTIFICATION

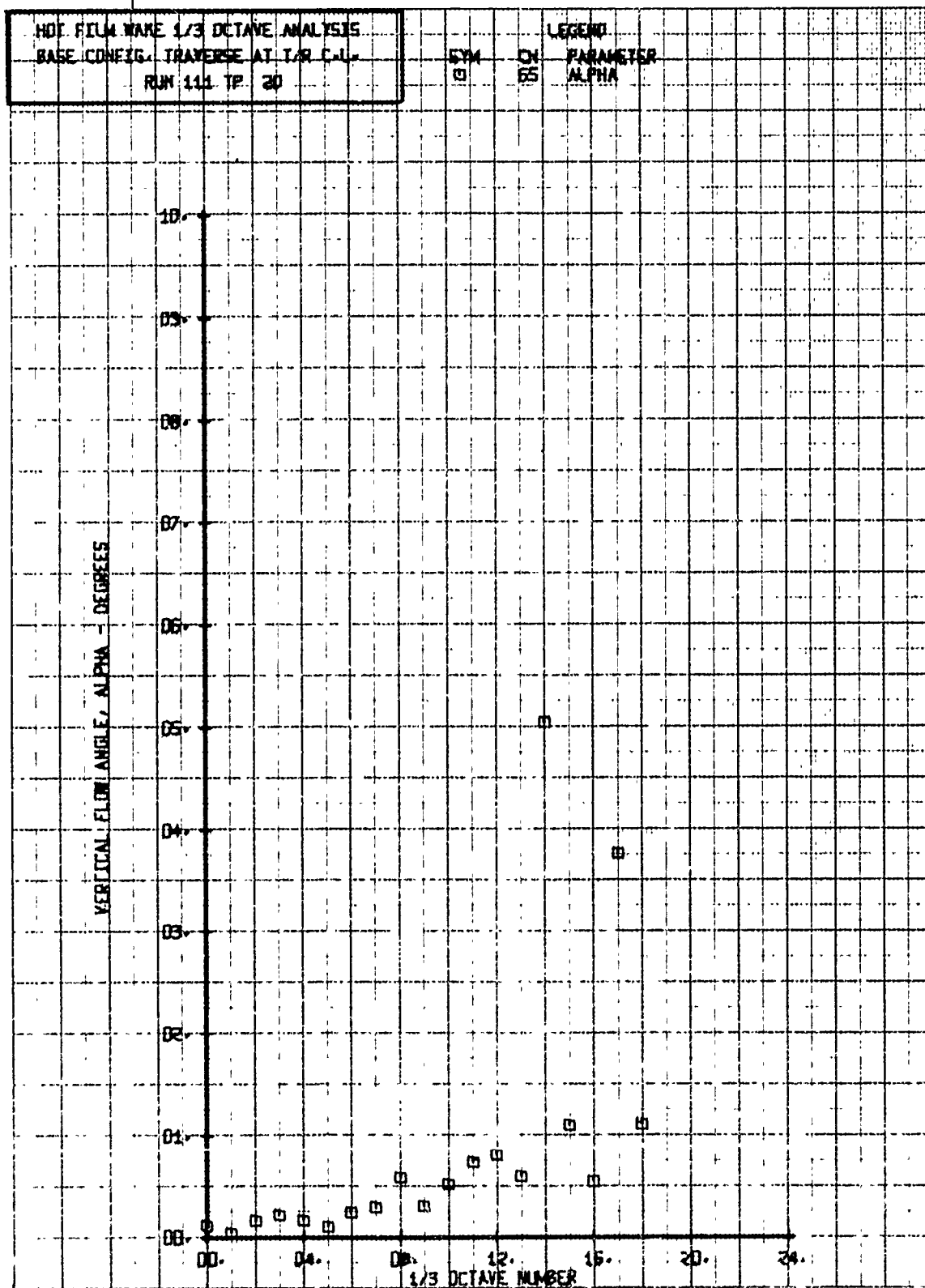
| BAND NUMBER | BAND WIDTH - Hz |        |         |
|-------------|-----------------|--------|---------|
|             | MINIMUM         | CENTER | MAXIMUM |
| 0           | 3.5             | 3.4    | 4.4     |
| 1           | 4.4             | 4.9    | 5.5     |
| 2           | 5.5             | 6.2    | 7.0     |
| 3           | 7.0             | 7.8    | 8.7     |
| 4           | 8.7             | 9.8    | 11.0    |
| 5           | 11.0            | 12.4   | 13.9    |
| 6           | 13.4            | 15.6   | 17.5    |
| 7           | 17.5            | 19.7   | 22.1    |
| 8           | 22.1            | 24.8   | 27.8    |
| 9           | 27.8            | 31.25  | 35.1    |
| 10          | 35.1            | 39.4   | 44.2    |
| 11          | 44.2            | 49.6   | 55.7    |
| 12          | 55.7            | 62.5   | 70.2    |
| 13          | 70.2            | 78.7   | 88.9    |
| 14          | 88.9            | 99.2   | 111.4   |
| 15          | 111.4           | 125.0  | 140.3   |
| 16          | 140.3           | 157.5  | 176.8   |
| 17          | 176.8           | 198.4  | 222.7   |
| 18          | 222.7           | 250.0  | 280.6   |

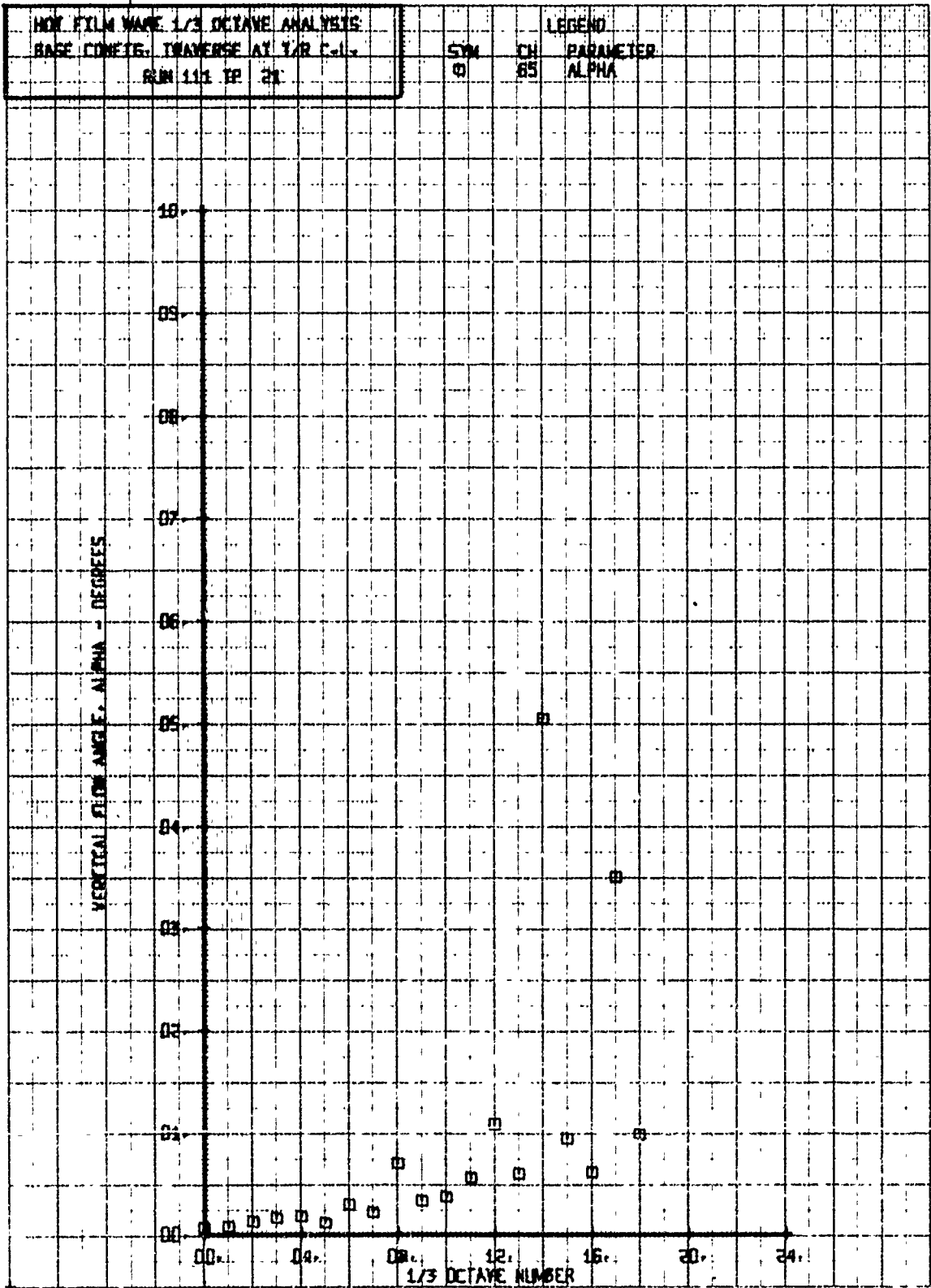
HOT FILM WAKE 1/3 OCTAVE ANALYSIS  
 BASE CONFIG. TRAVERSE AT T/R C/L  
 RUN 111 TP 20

SYM  
 □

ON  
 65

LEGEND  
 PARAMETER  
 ALPHA

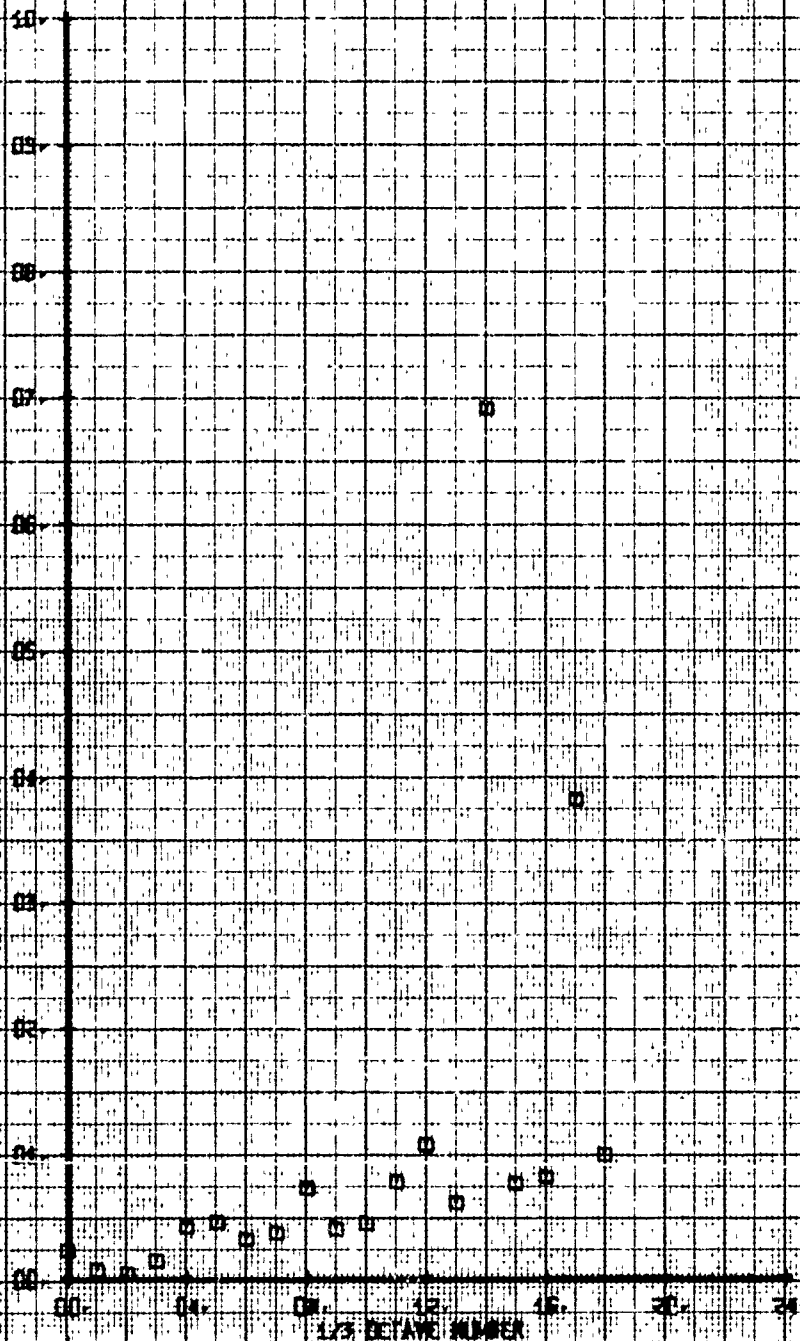




HOT FILM WAVE 1/3 OCTAVE ANALYSIS  
 BASE CONFIG. TRAVERSE AT 1/2 C.I.  
 RUN 111 TP. 22

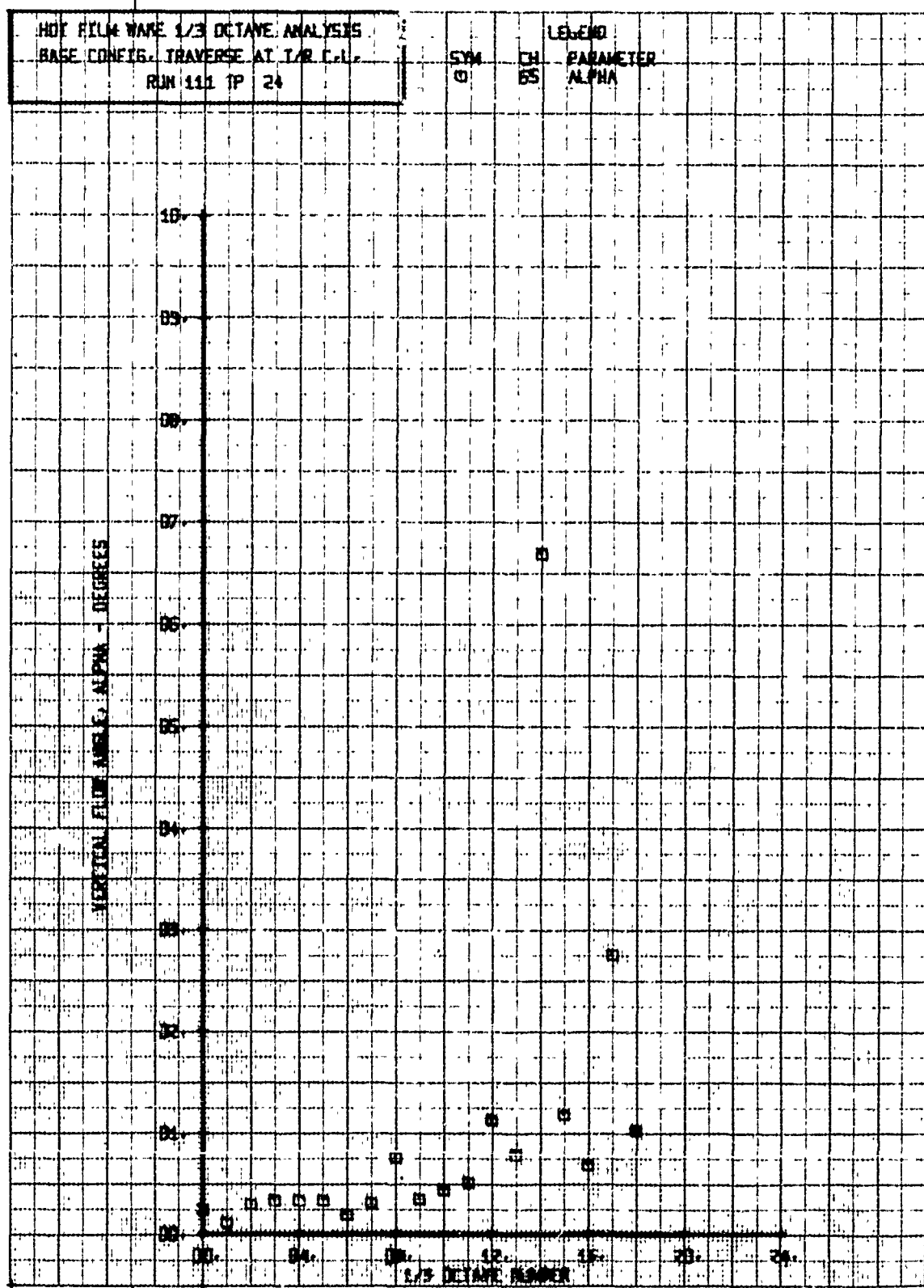
| SYM | CH | PARAMETER |
|-----|----|-----------|
| 0   | 65 | ALPHA     |

VERTICAL FLOW ANGLE, ALPHA - DEGREES

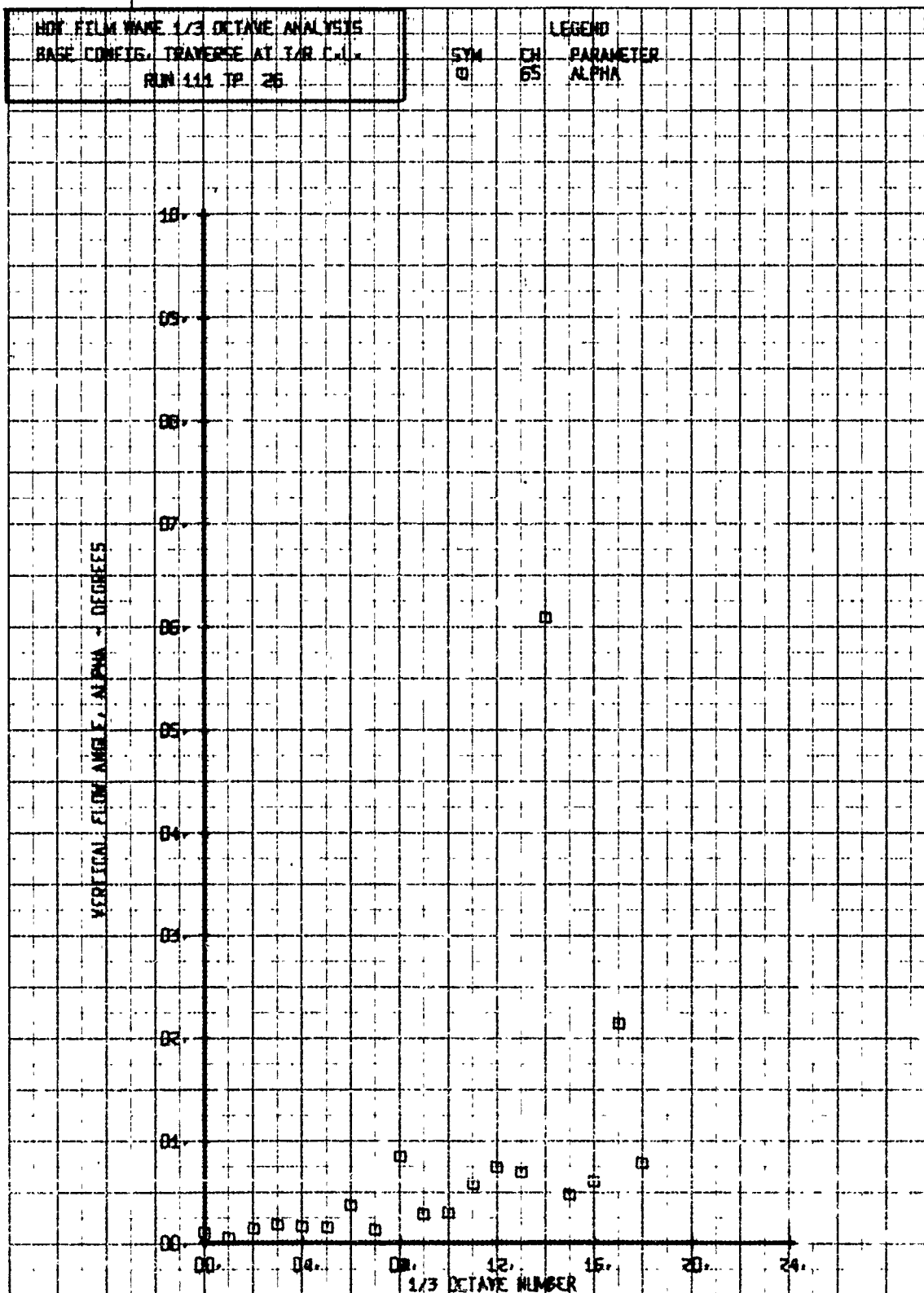


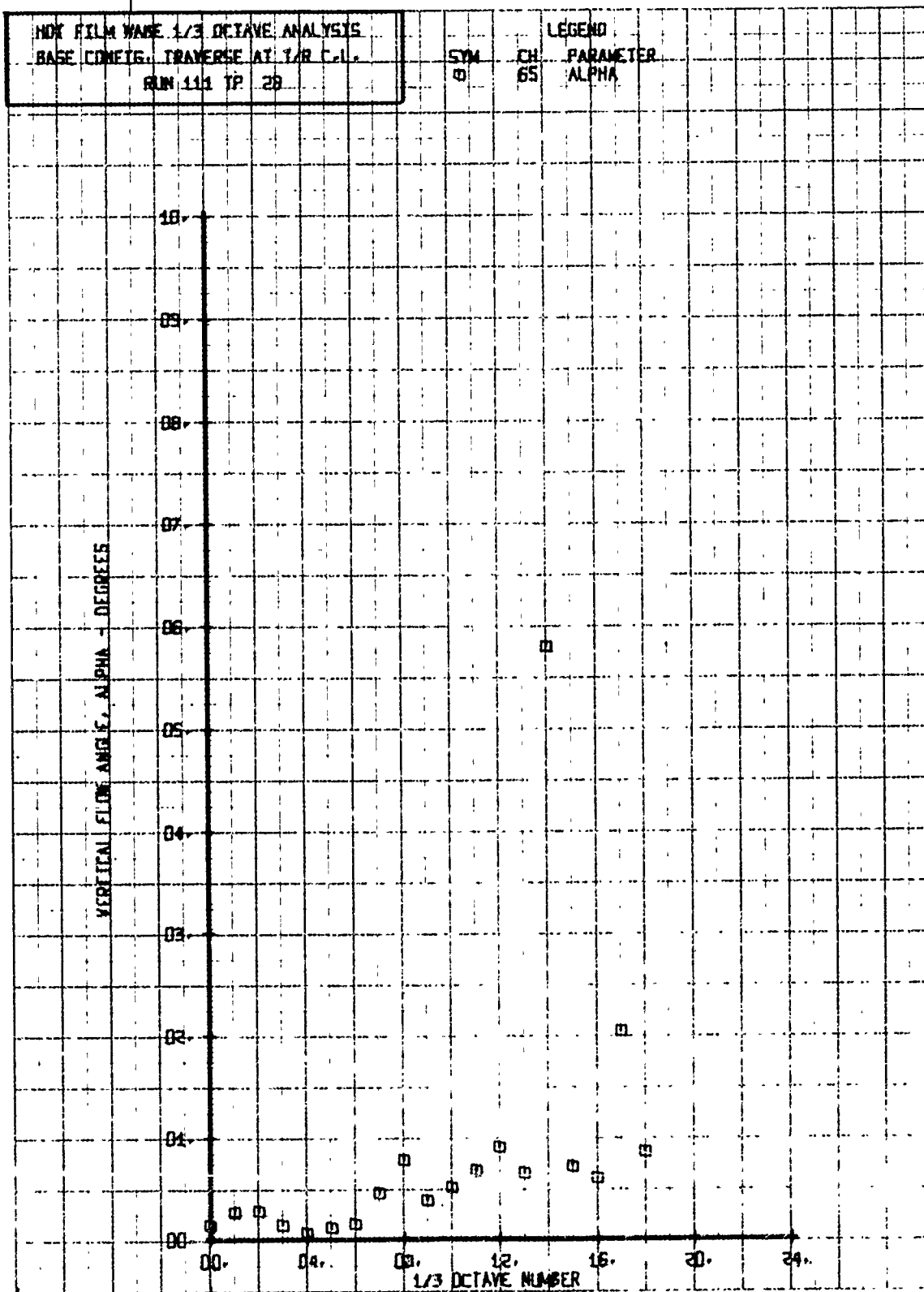
HOT FILM WAVE 1/3 OCTAVE ANALYSIS  
 BASE CONFIG. TRAVERSE AT T/R C.L.  
 RUN 111 TP 24

SYN CH  
 0 65  
 PARAMETER  
 ALPHA



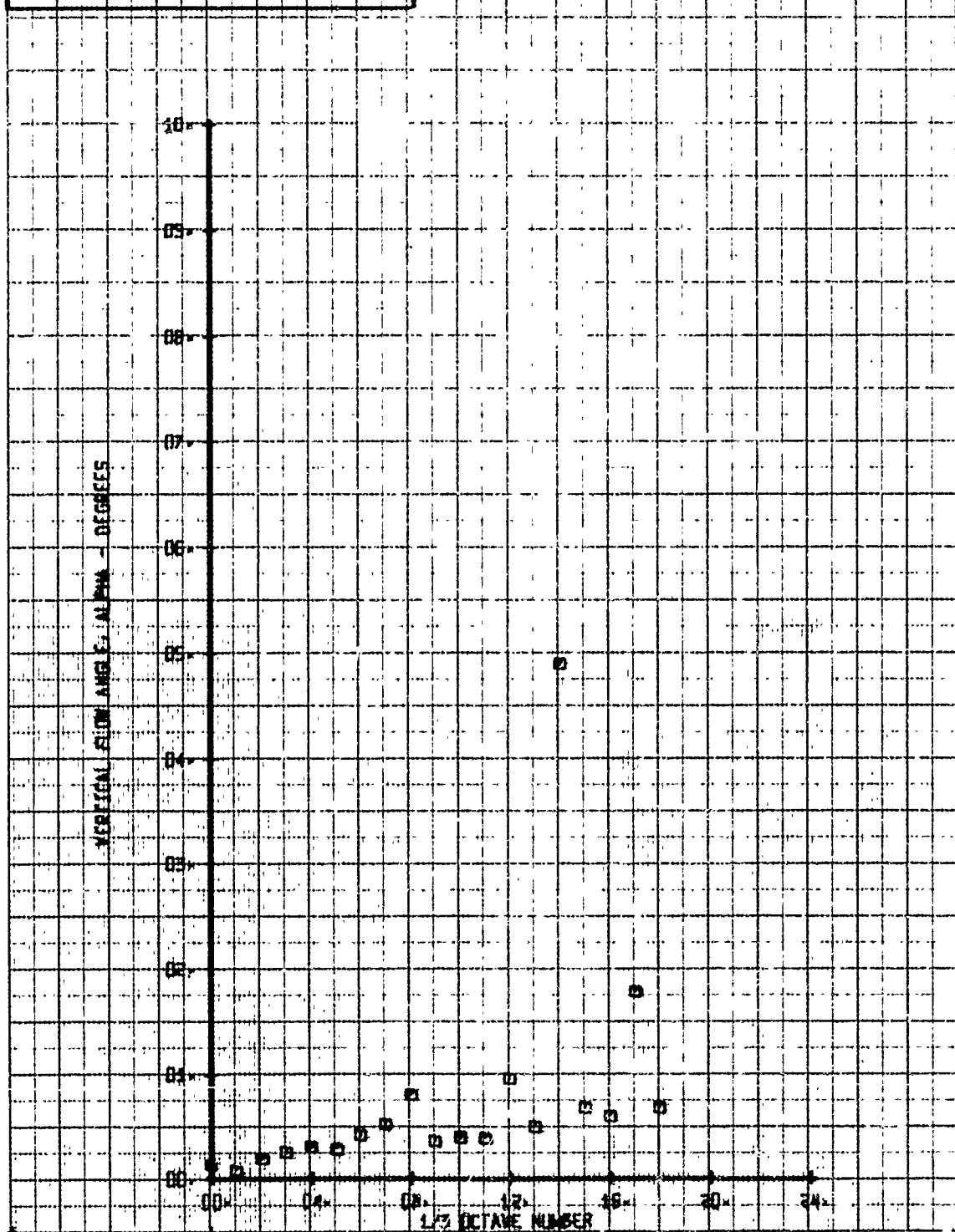


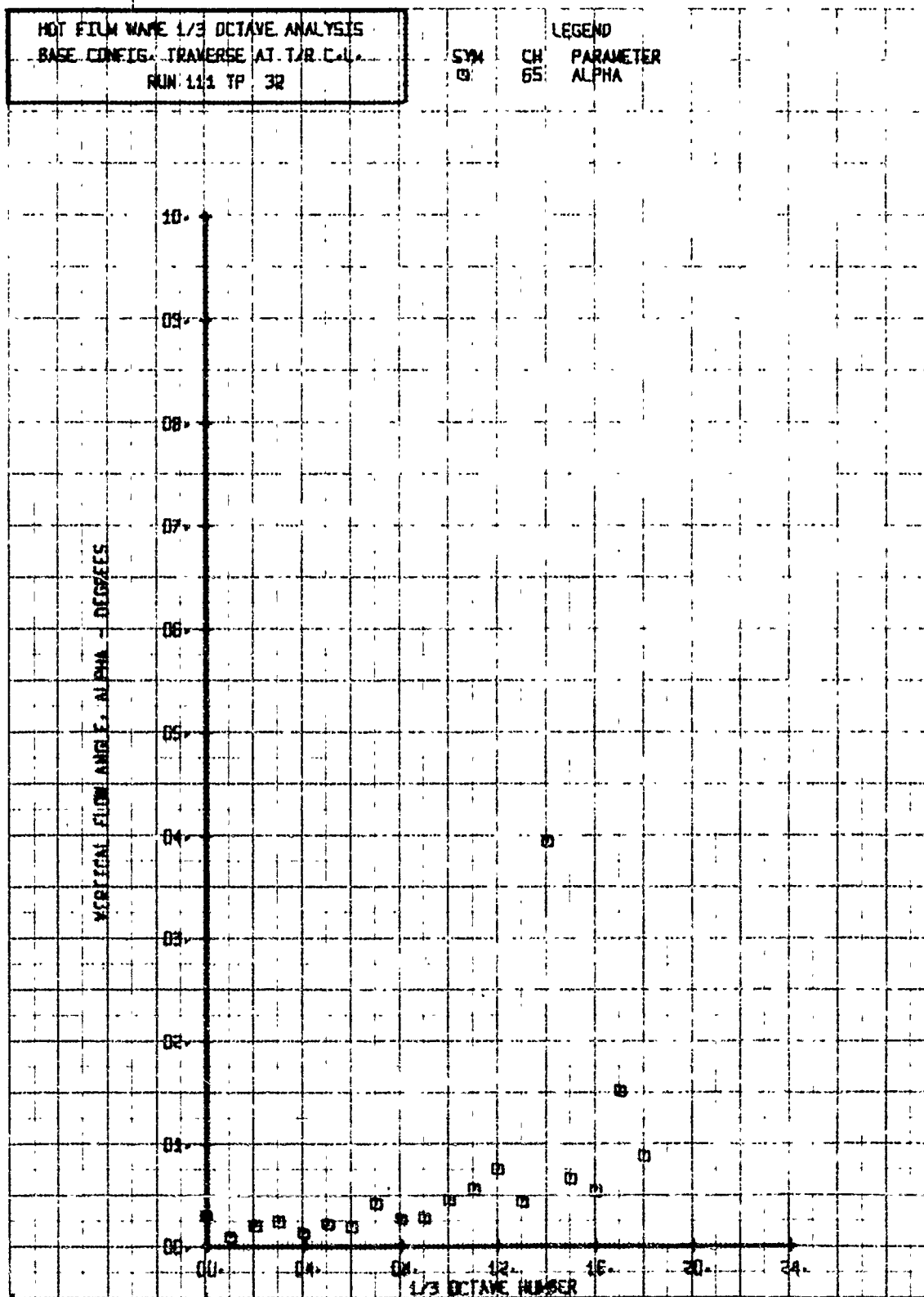


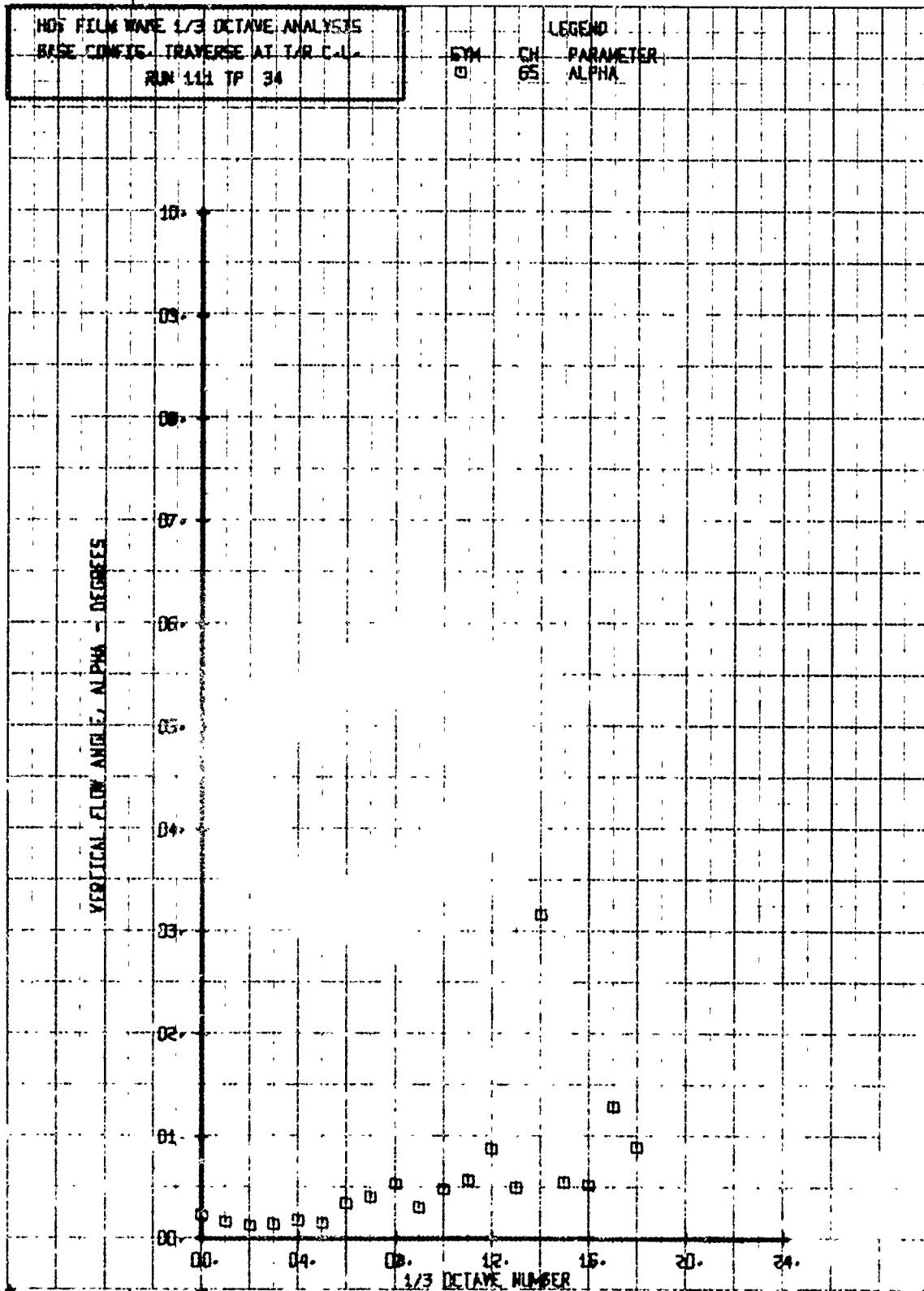


HOT FILM WAVE 1/3 OCTAVE ANALYSIS  
 BASE CONFIG. TRAVERSE AT 1/2 R.C.L.  
 RUN 111 TP 30

SYN CH  
 0 65  
 LEGEND  
 PARAMETER  
 ALPHA



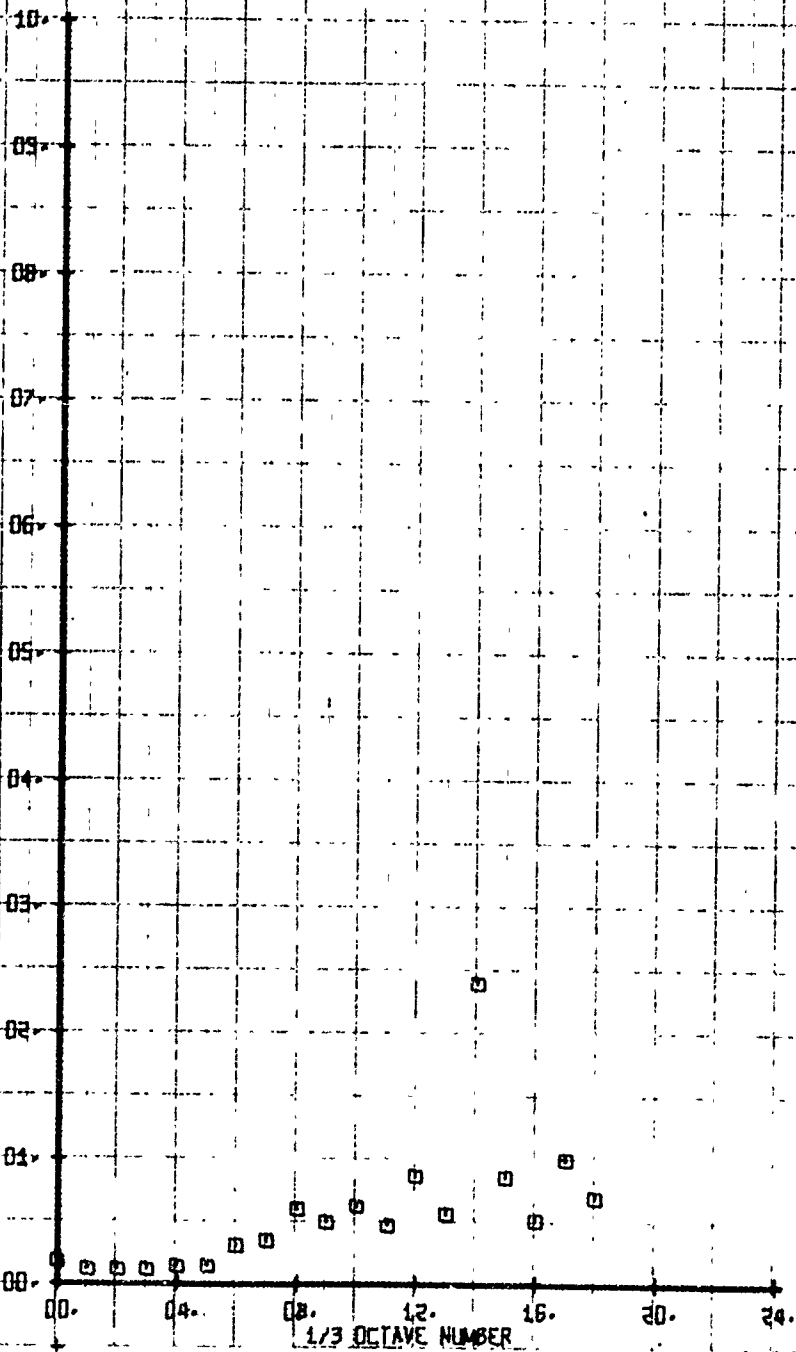




HOT FILM WAKE 1/3 OCTAVE ANALYSIS  
 BASE CONFIG. TRAVERSE AT T/R CAL.  
 RUN 111 TP 36

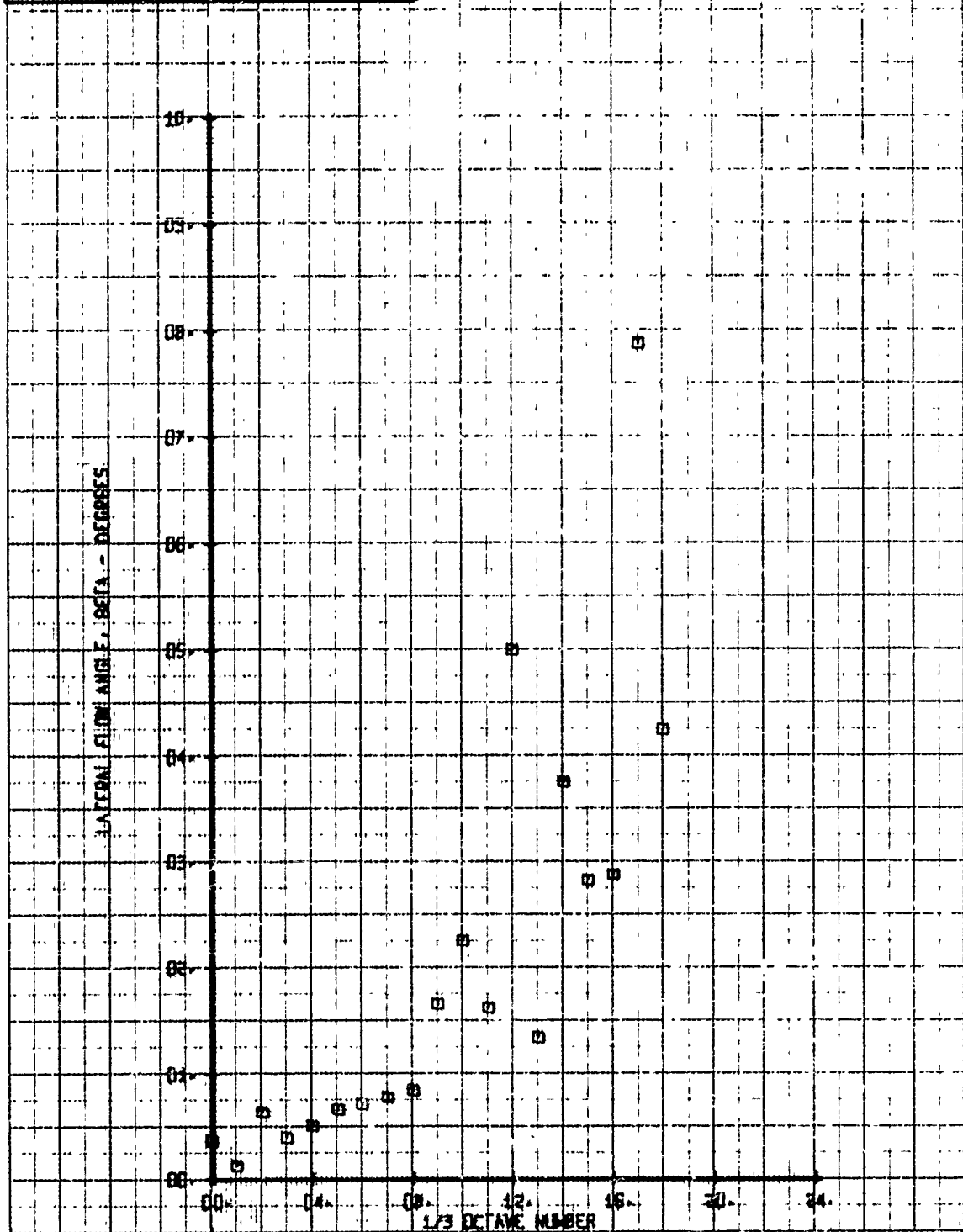
SYM CH PARAMETER  
 0 65 ALPHA

VERTICAL FLOW ANGLE, ALPHA - DEGREES



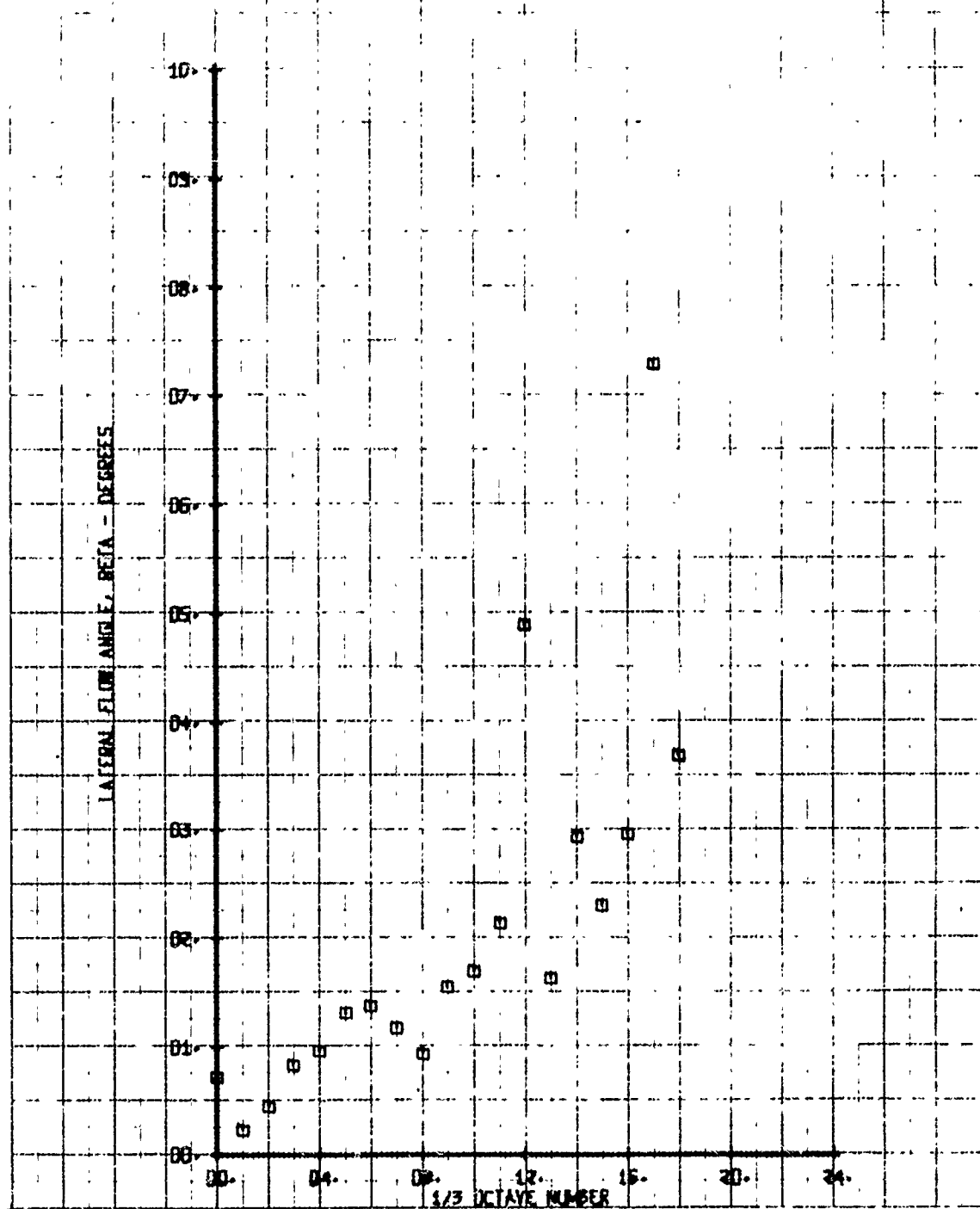
HOT FILM WAVE 1/3 OCTAVE ANALYSIS  
 BASE COND. TRANSVERSE AT T/R C.J.  
 RUN 101 P 20

SYM CH PARAMETER  
 0 66 BETA



HOT FILM WAKE 1/3 OCTAVE ANALYSIS  
 BASE CONFIG. TRAVERSE AT T/R C-L.  
 RUN 111 TP 21

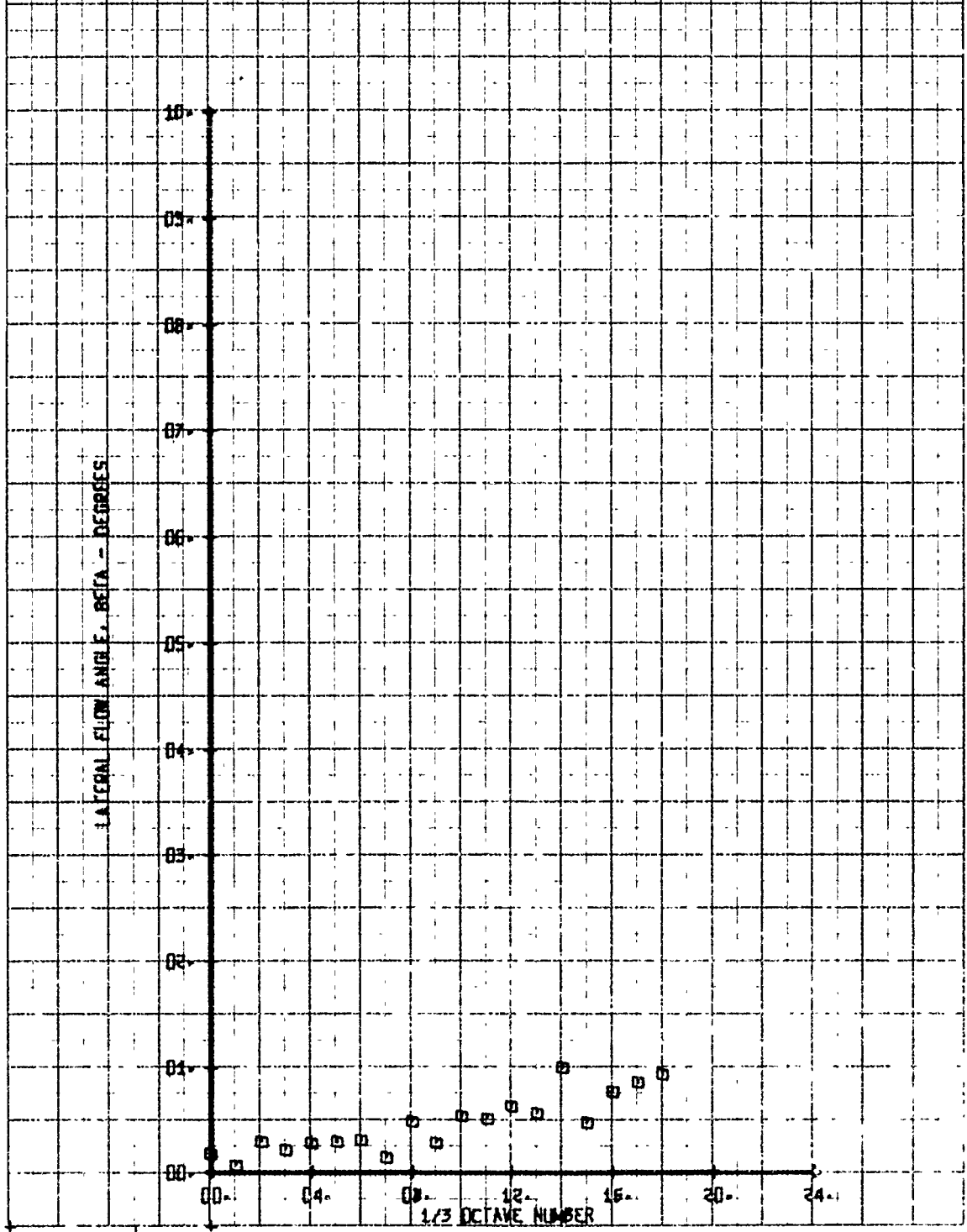
SYN CH LEGEND  
 66 66 PARAMETER  
 BETA

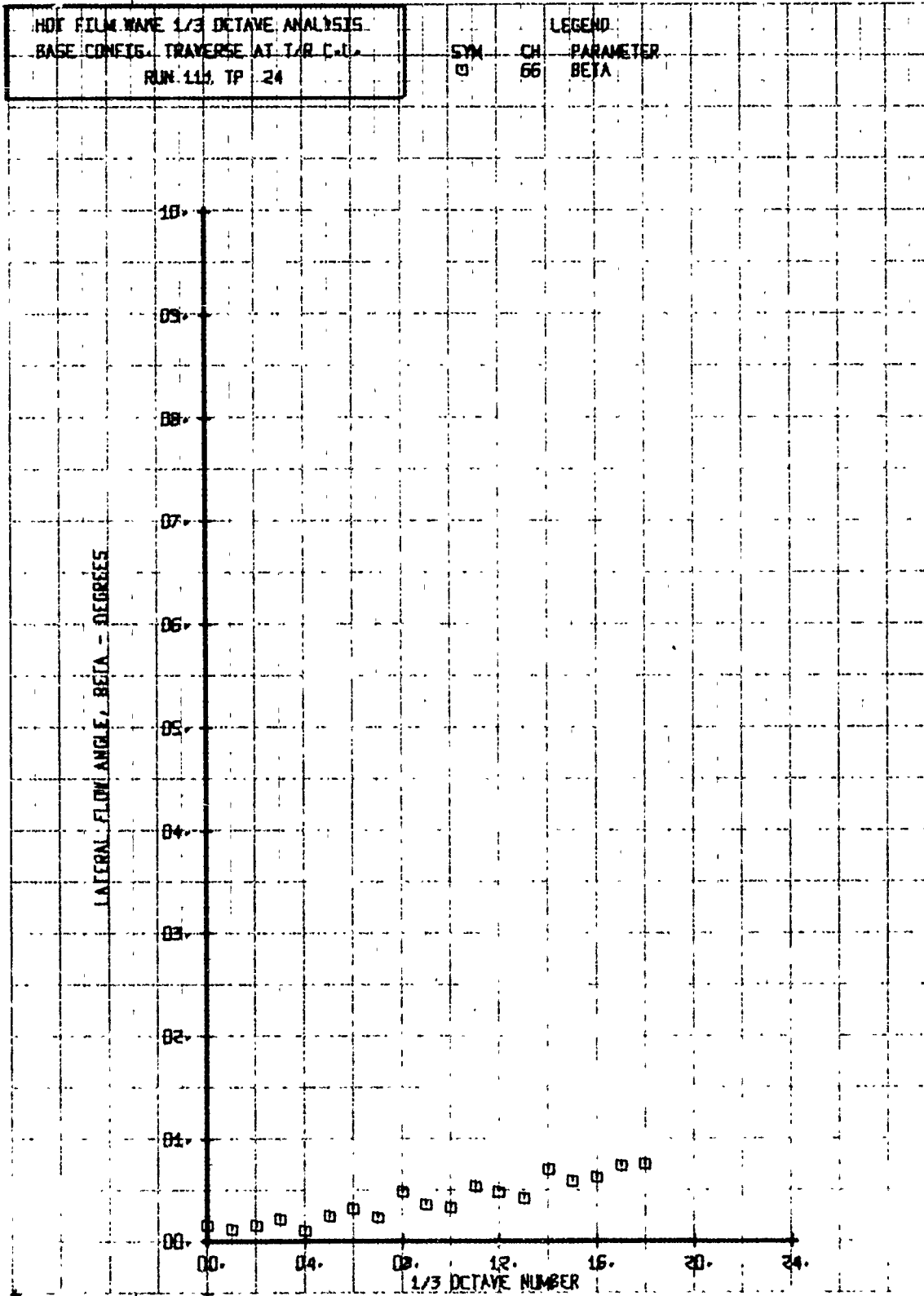




HOT FILM WAVE 1/3 OCTAVE ANALYSIS  
 BASE CONFIG. TRAVERSE AT T/R C.J.  
 RUN 111 TP 22

SYM CH  
 0 66  
 LEGEND  
 PARAMETER  
 BETA



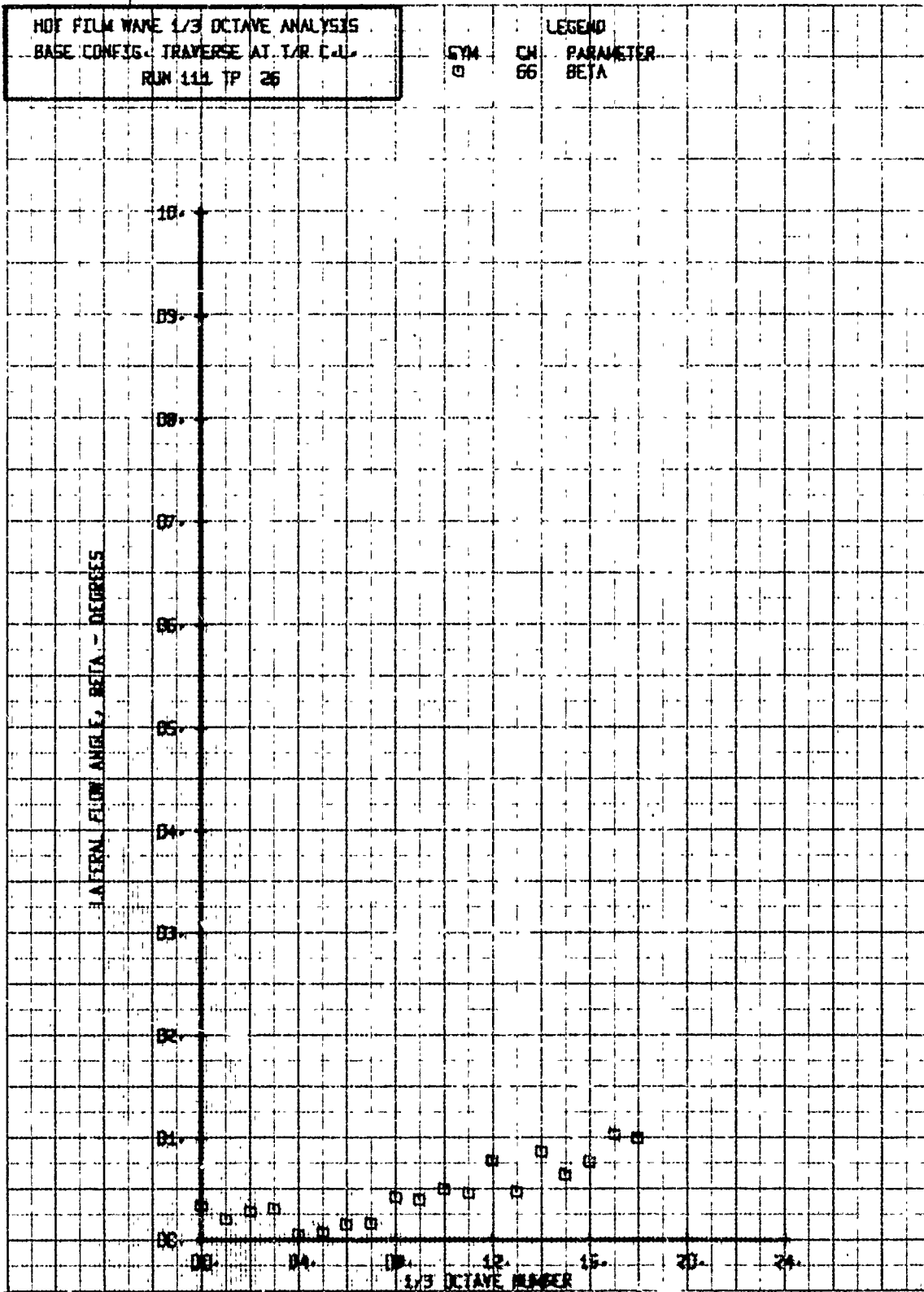


HOT FILM WAVE 1/3 OCTAVE ANALYSIS  
 BASE CONFIG. TRAVERSE AT 1/4 C.L.  
 RUN 111 TP 26

SYM  
 0

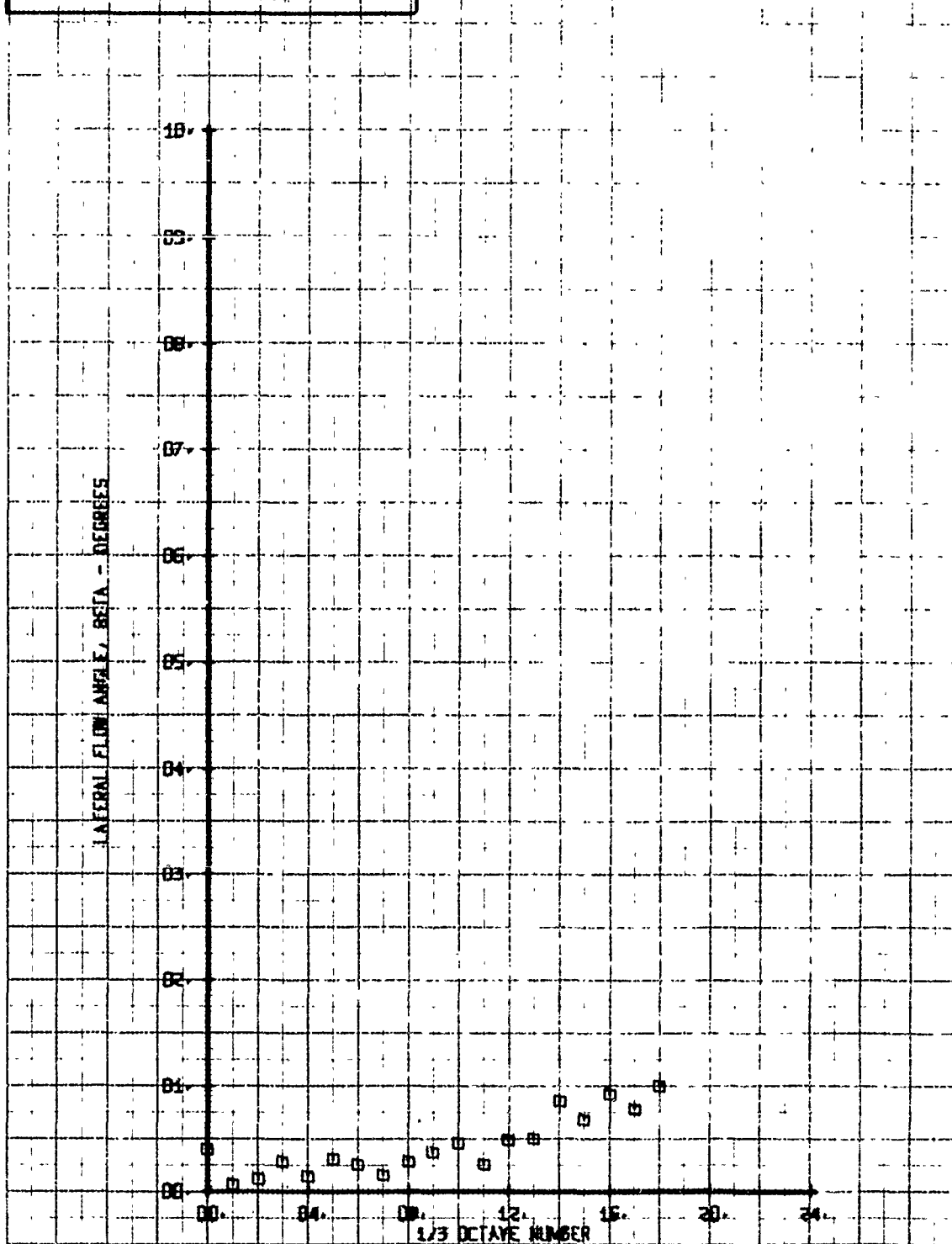
CH  
 66

LEGEND  
 PARAMETER  
 BETA



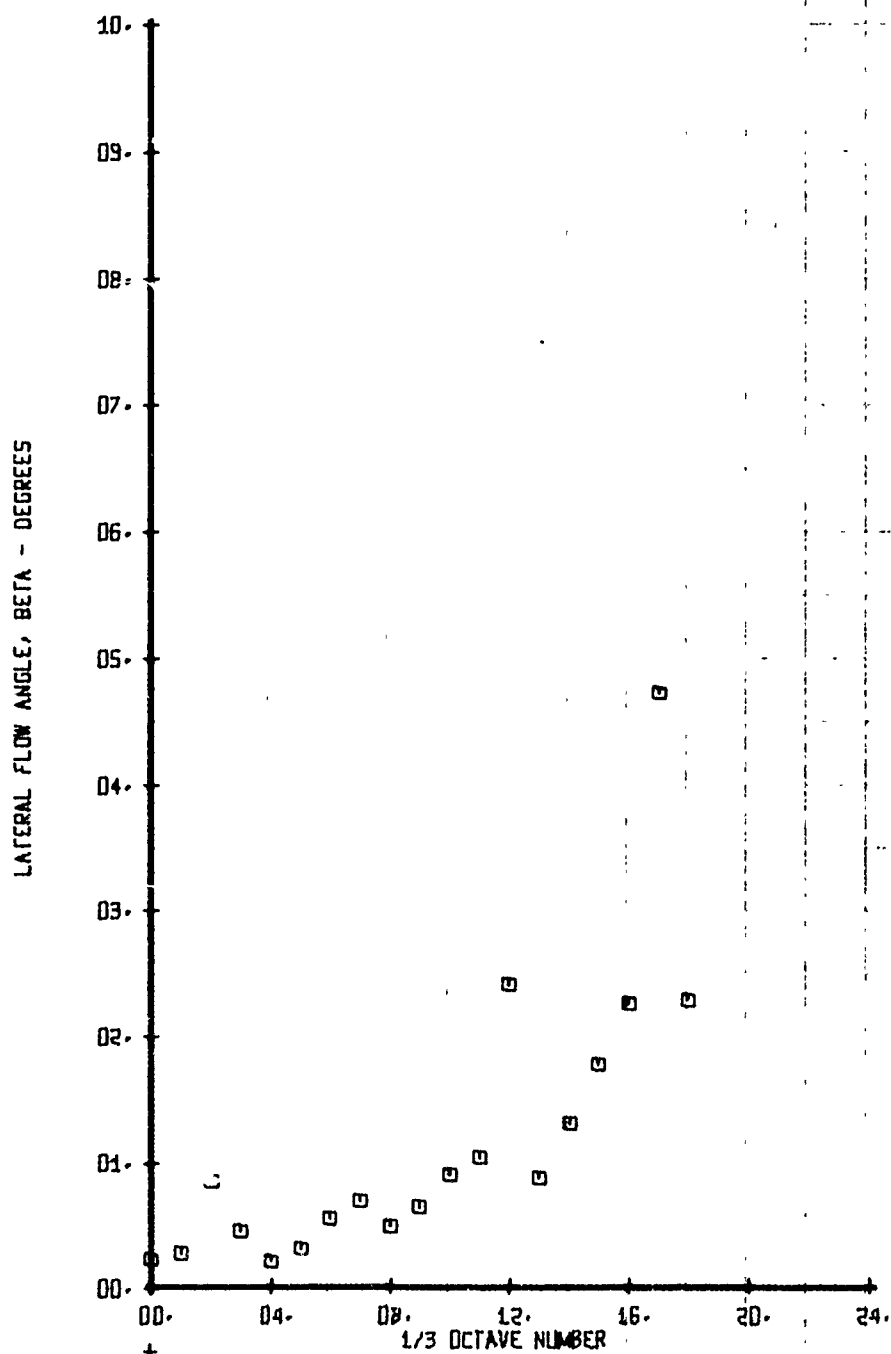
HOT FILM WAVE 1/3 OCTAVE ANALYSIS  
 BASE CORRECTED TRAVERSE AT 1/R C.L.  
 RUN 111 TP 30

SYN CH PARAMETER  
 0 66 BETA



HOT FILM WAKE 1/3 OCTAVE ANALYSIS  
 BASE CONFIG. TRAVERSE AT T/R C.C.  
 RUN 111 TP 32

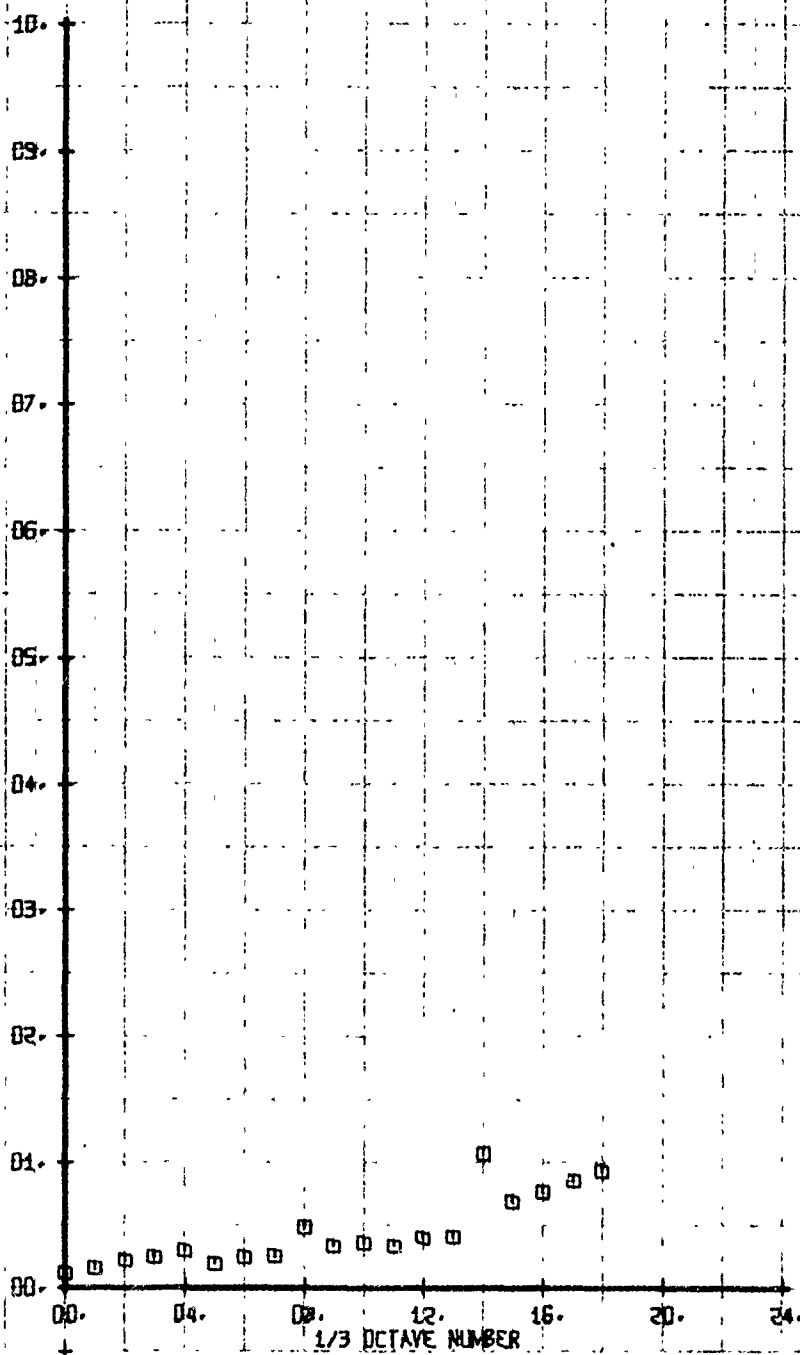
| SYM | CH | LEGEND            |
|-----|----|-------------------|
| □   | 66 | PARAMETER<br>BETA |



HOT FILM WAKE 1/3 OCTAVE ANALYSIS  
 BASE CONFIG. TRAVERSE AT 1/R C.L.  
 RUN 111 TP 34

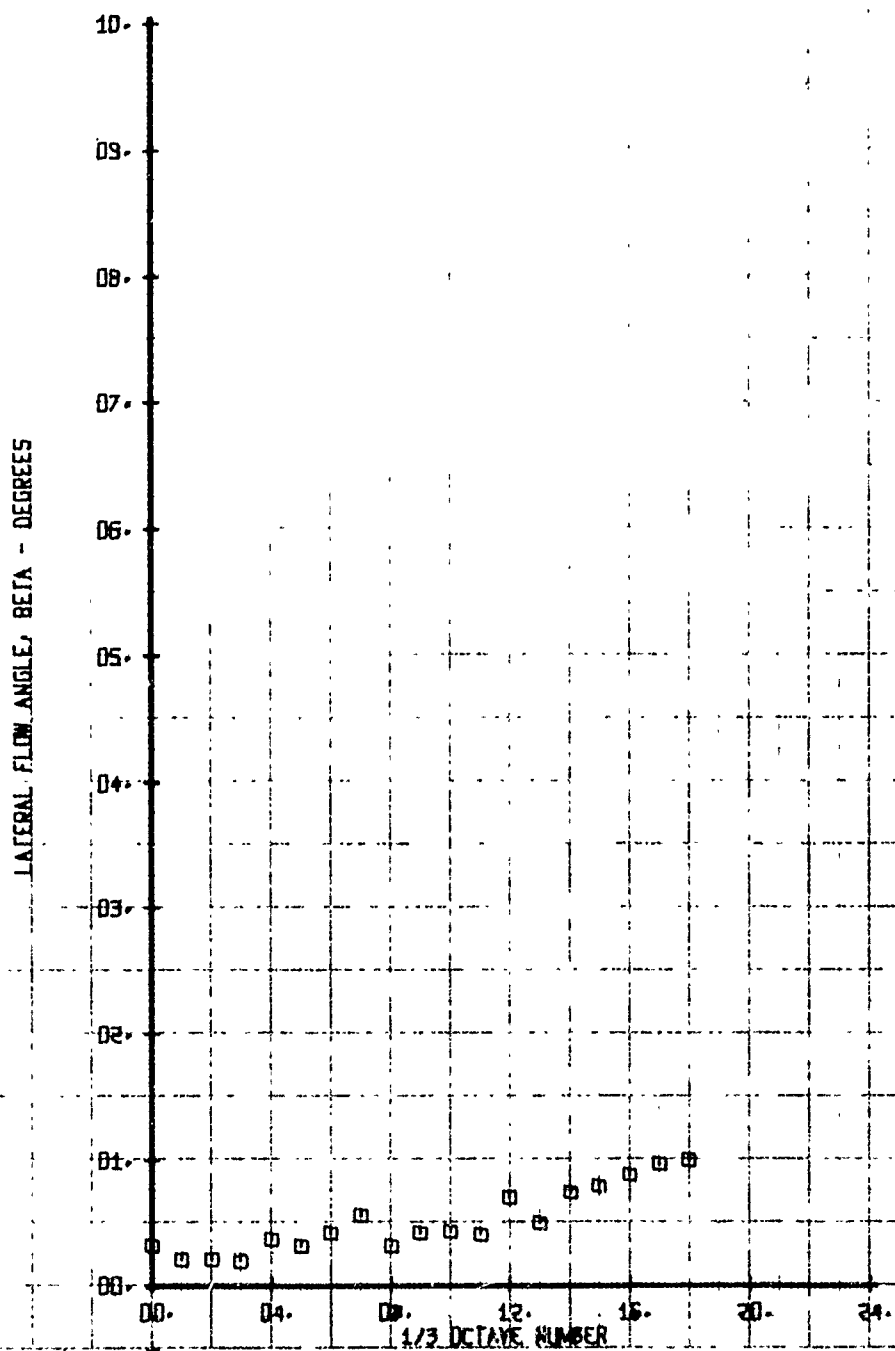
SYN CH PARAMETER  
 0 66 BETA

LATERAL FLOW ANGLE, BETA - DEGREES



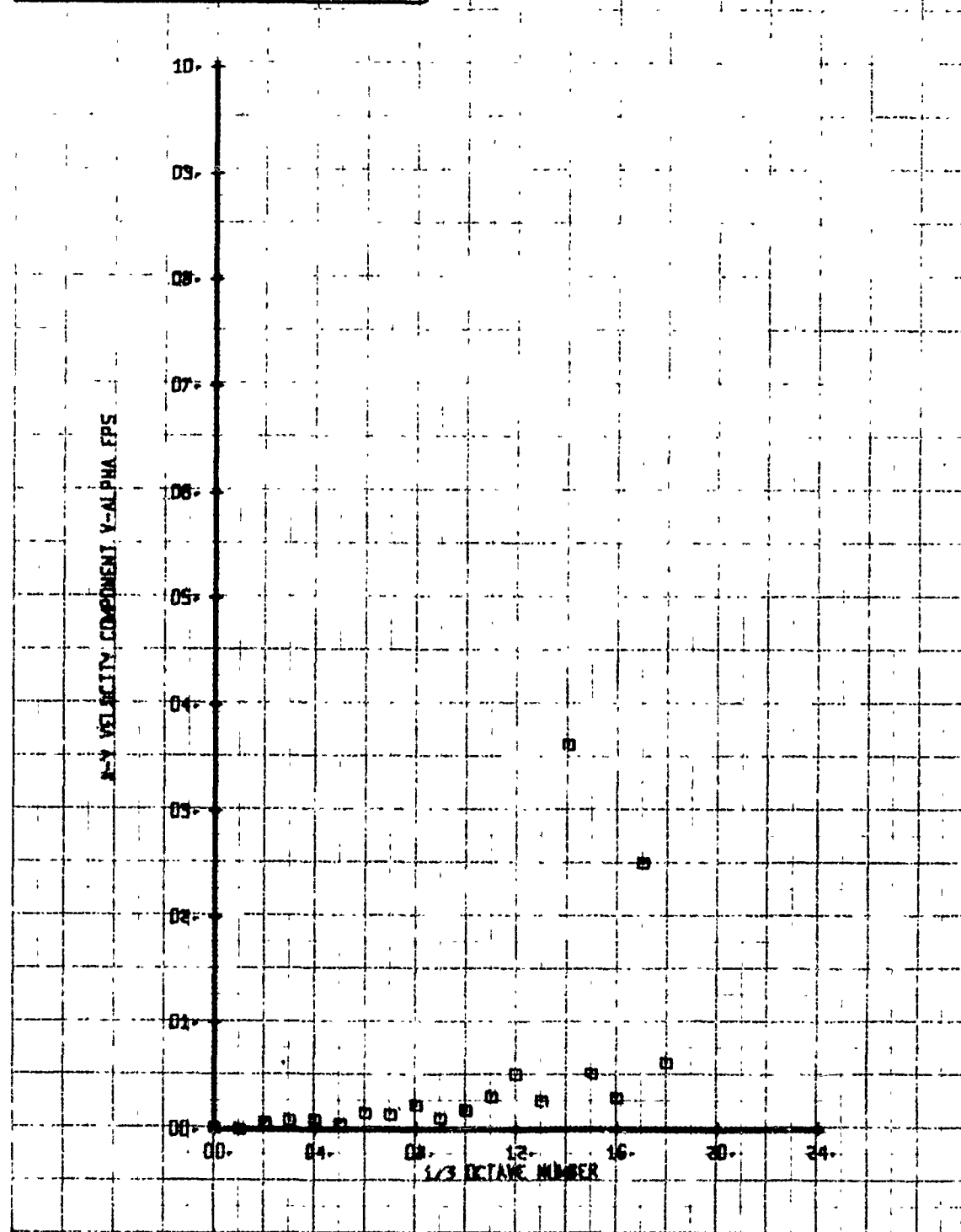
HOT FILM WAKE 1/3 OCTAVE ANALYSIS  
BASE CONFIG. TRAVERSE AT T/R C-L.  
RUN 111 TP 36

LEGEND  
SYM CH PARAMETER  
□ 66 BETA

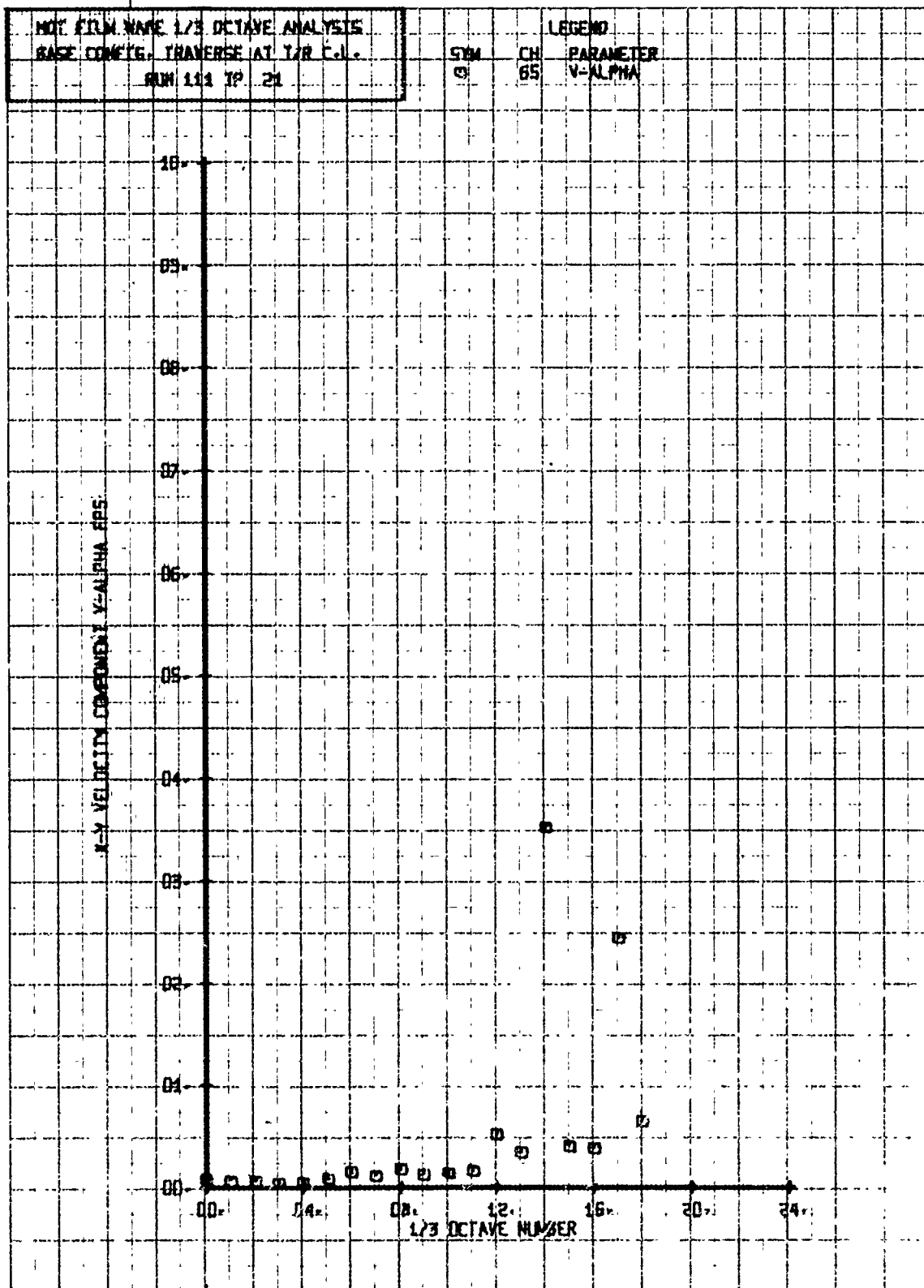


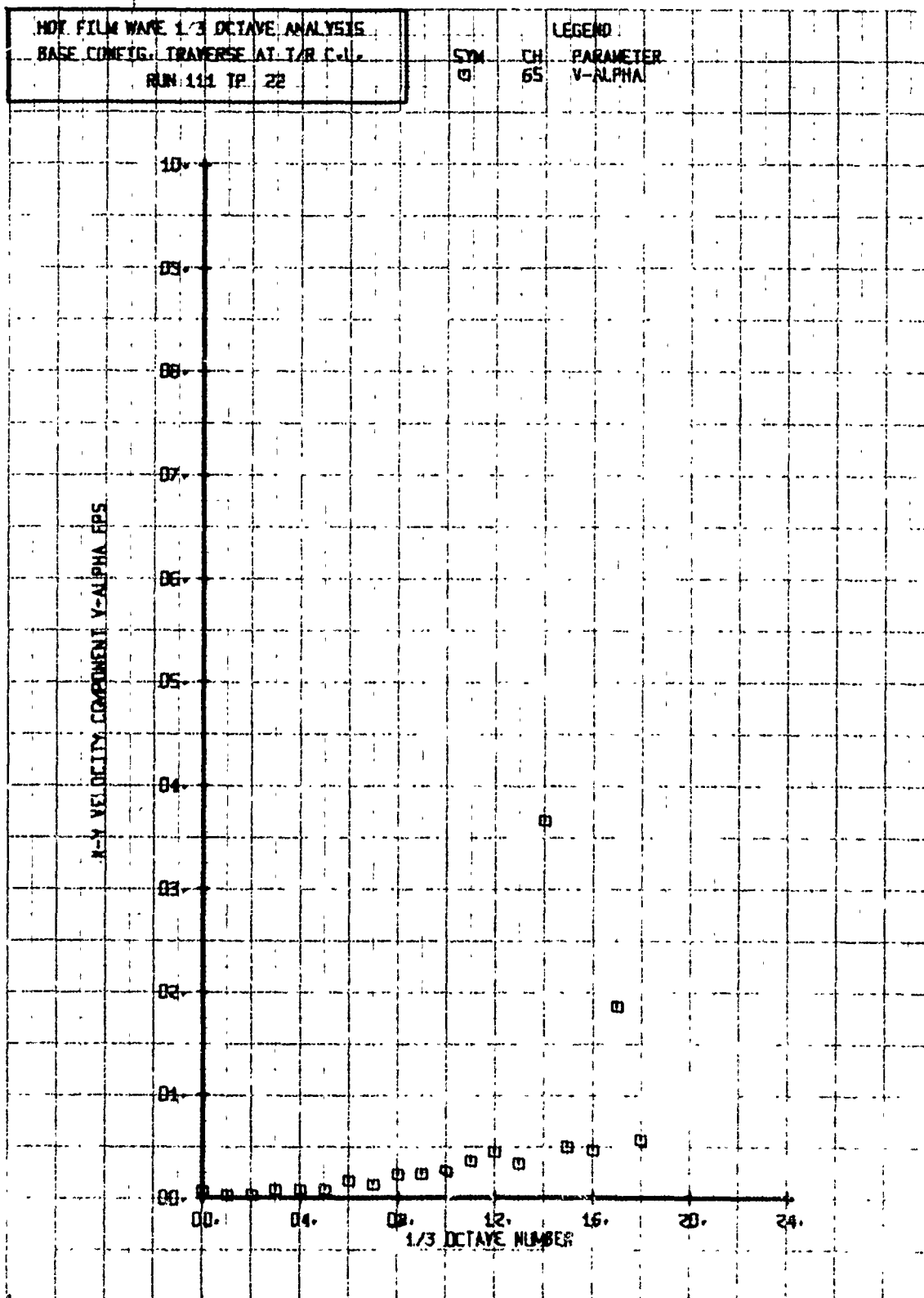
HOT FILM WAKE 1/3 OCTAVE ANALYSIS  
 BASE CONFIG. TRAVERSE AT T/R C-L-  
 RUN 111 TP 20

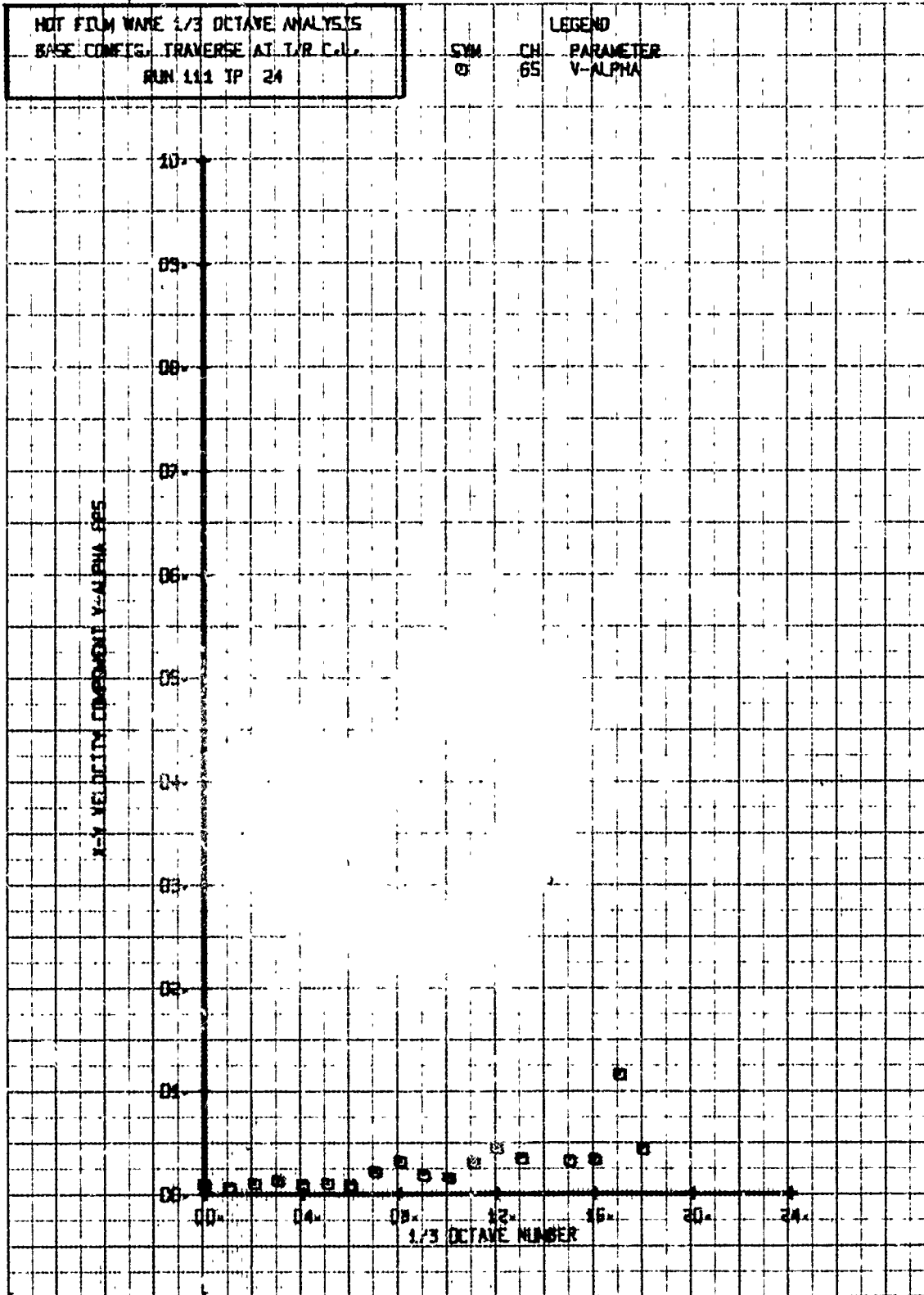
SYN CH PARAMETER  
 0 65 V-ALPHA





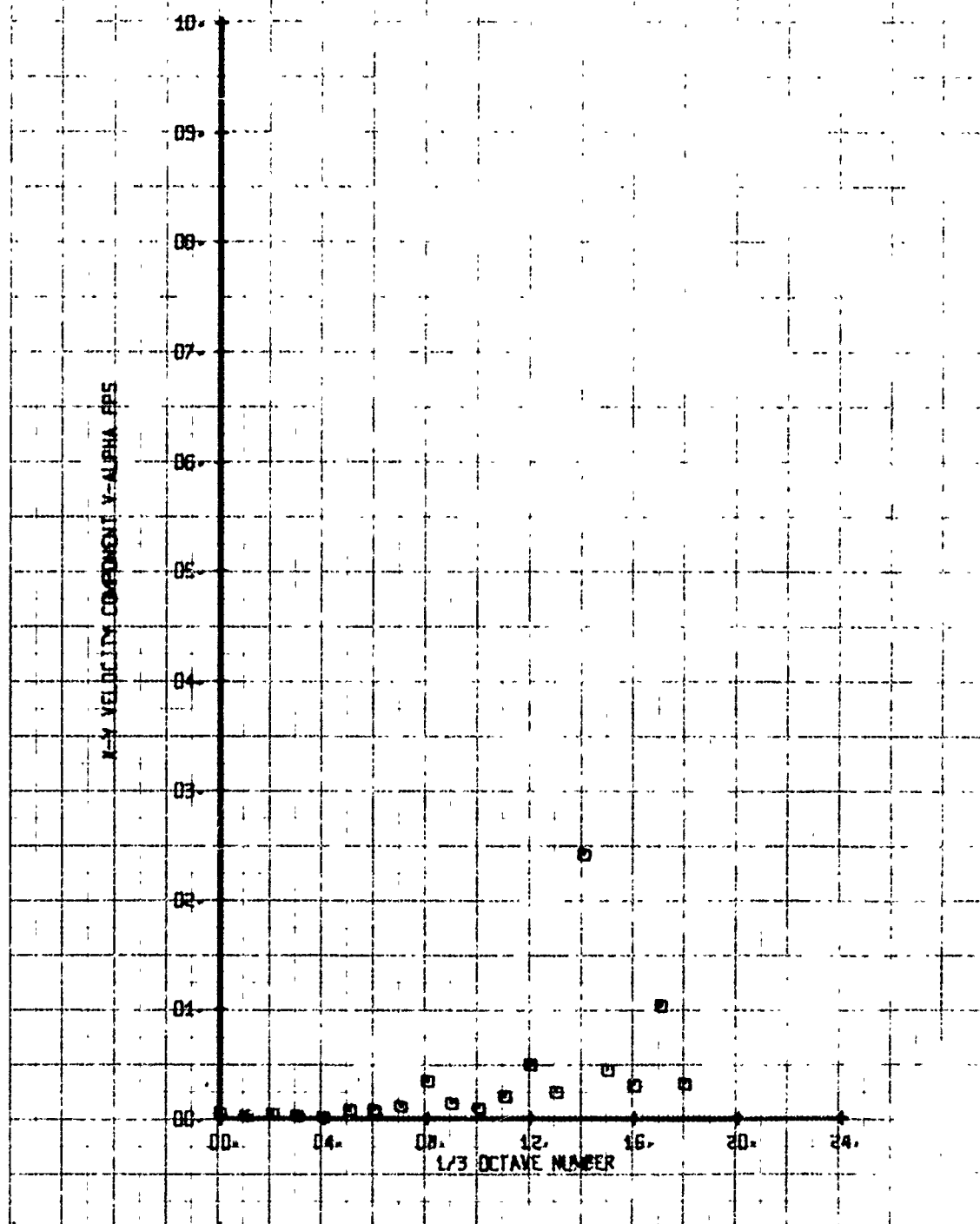


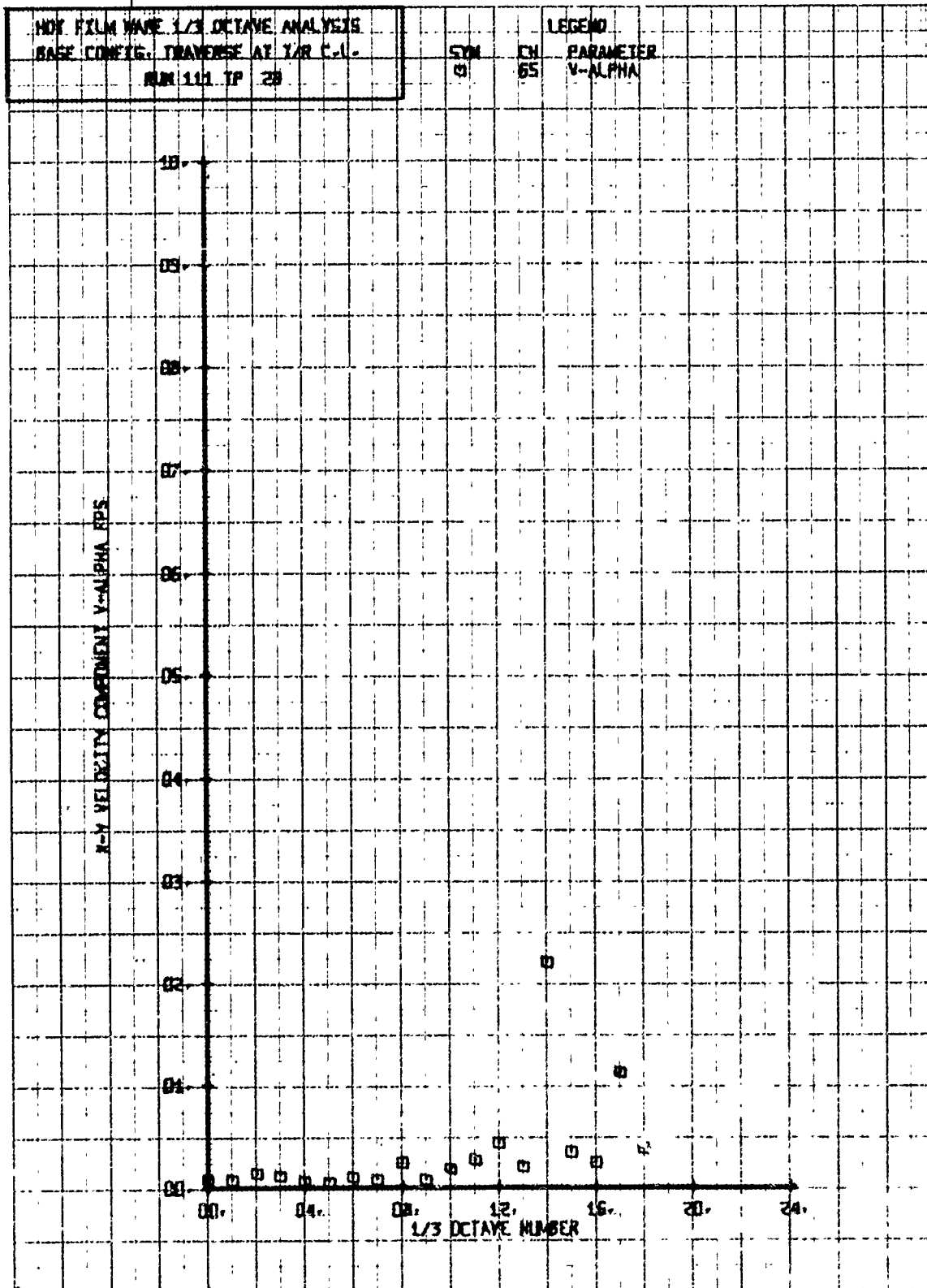


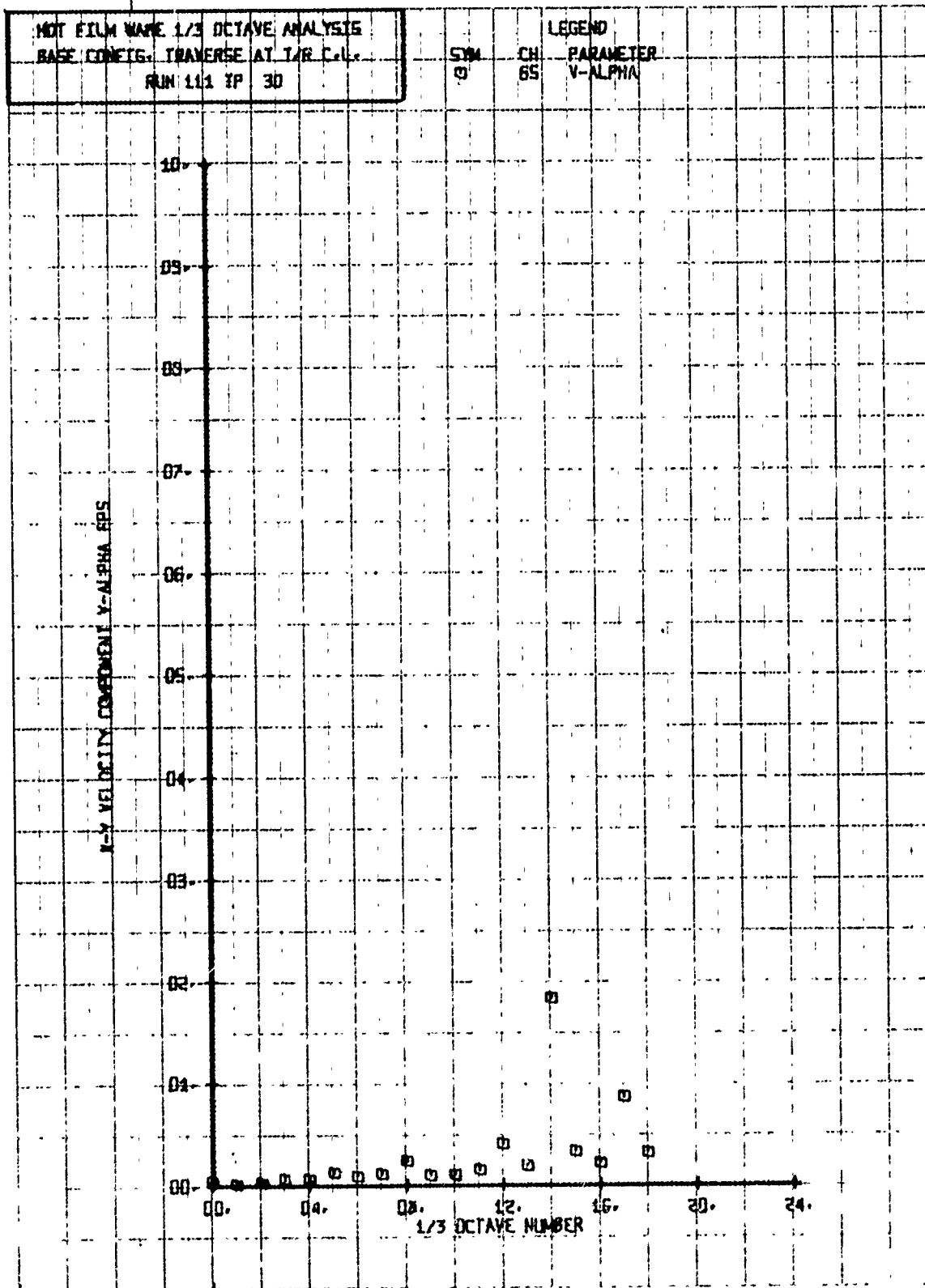


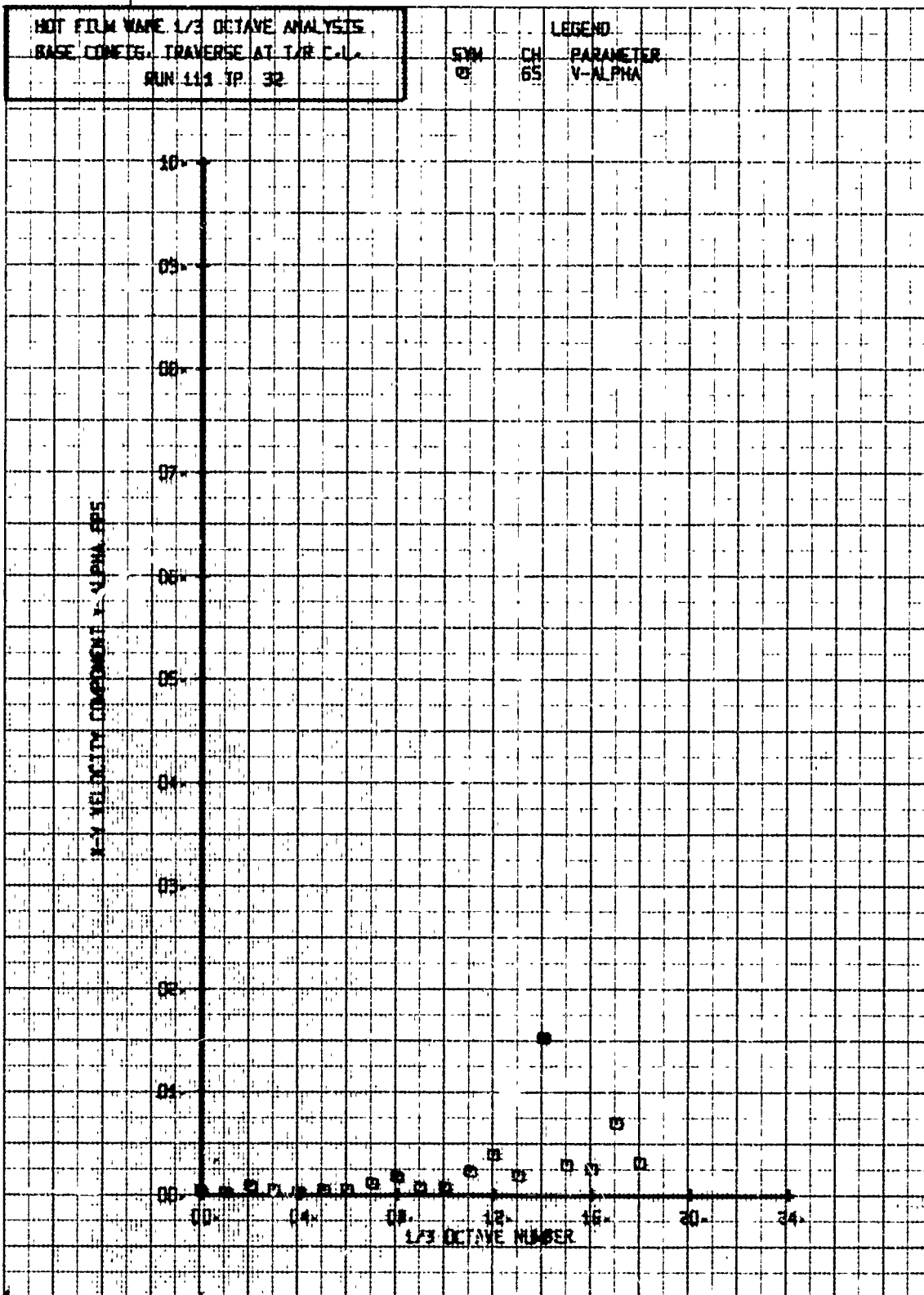
HOT FILM WAVE 1/3 OCTAVE ANALYSIS  
 BASE CONFIG. TRAVERSE AT 1/2 R.C.L.  
 RUN 111 TP 26

LEGEND  
 CH. 65  
 PARAMETER  
 V-ALPHA



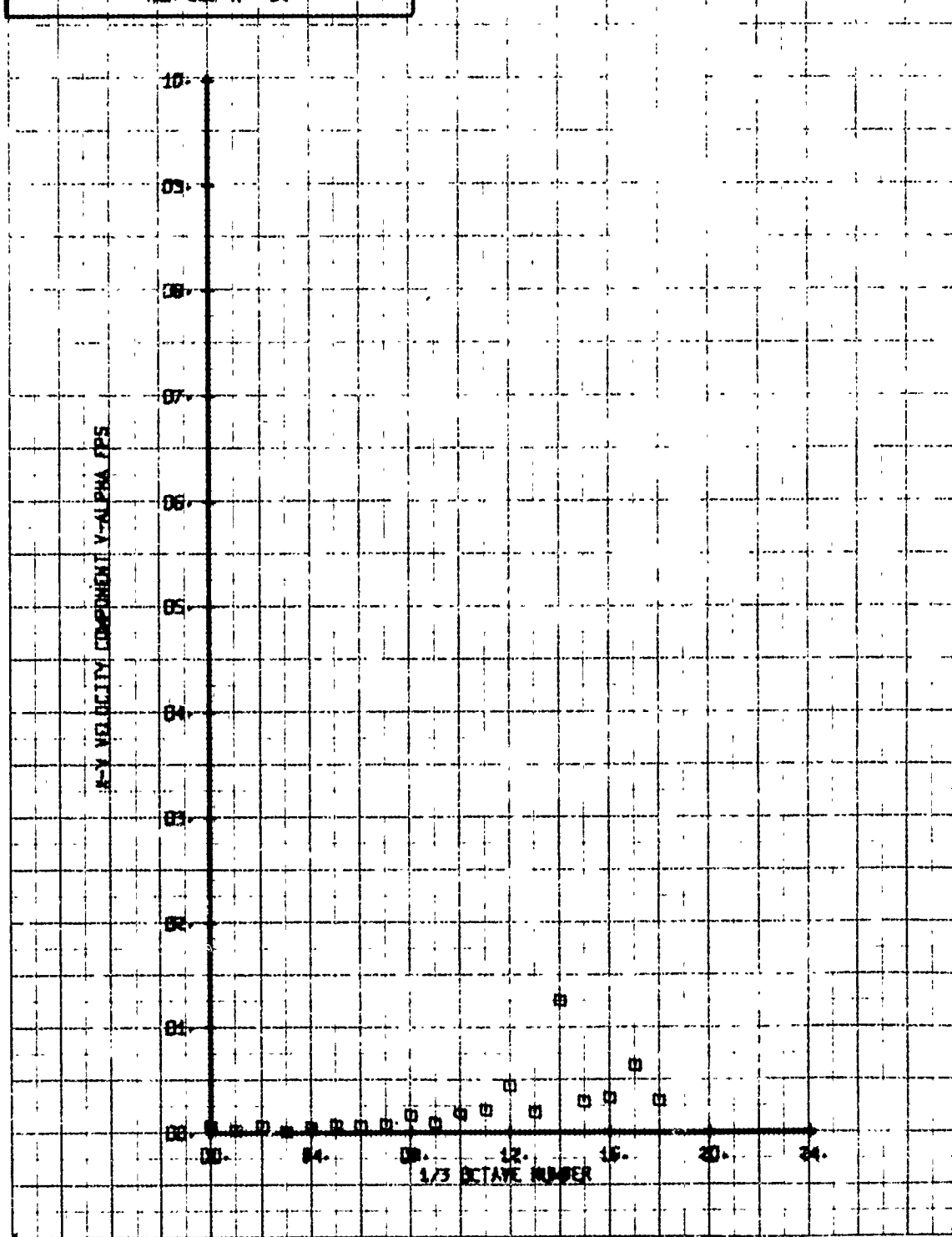




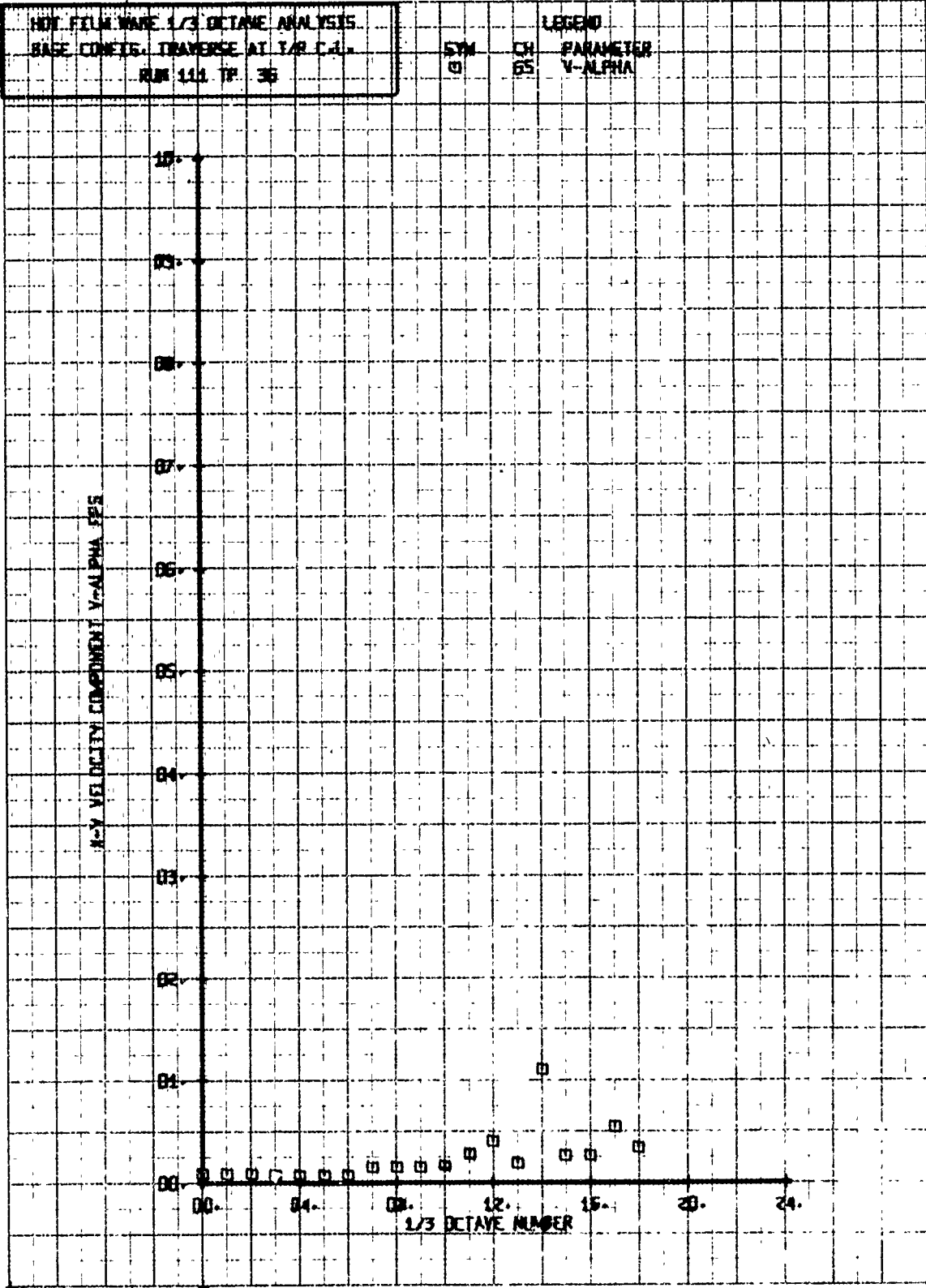


HOT FILM WIRE 1/3 OCTAVE ANALYSIS  
 BASE CONFIG. TRAVERSE AT T/R C.L.  
 RUN 111 TP 34

SYN CH PARAMETER  
 0 65 V-ALPHA



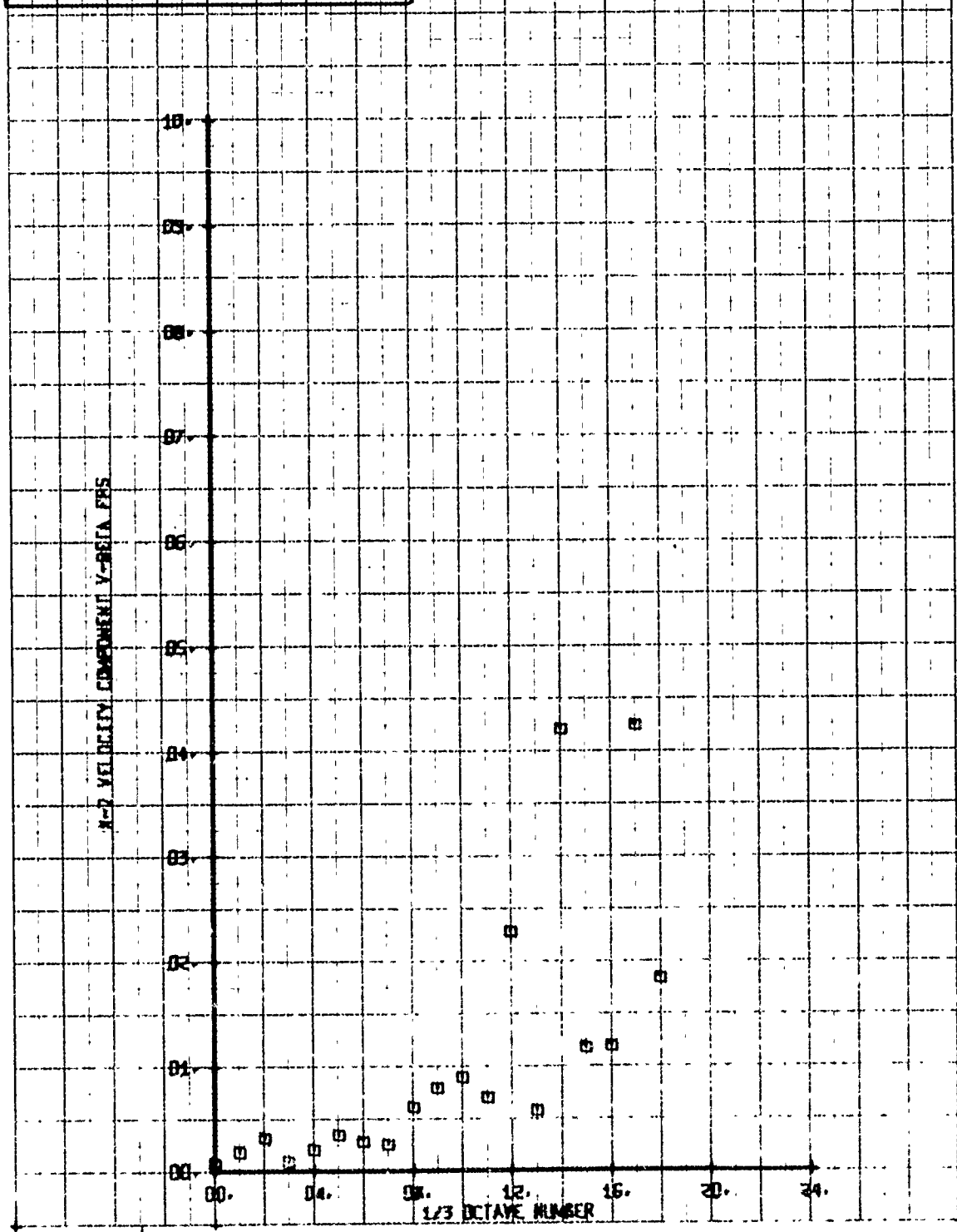


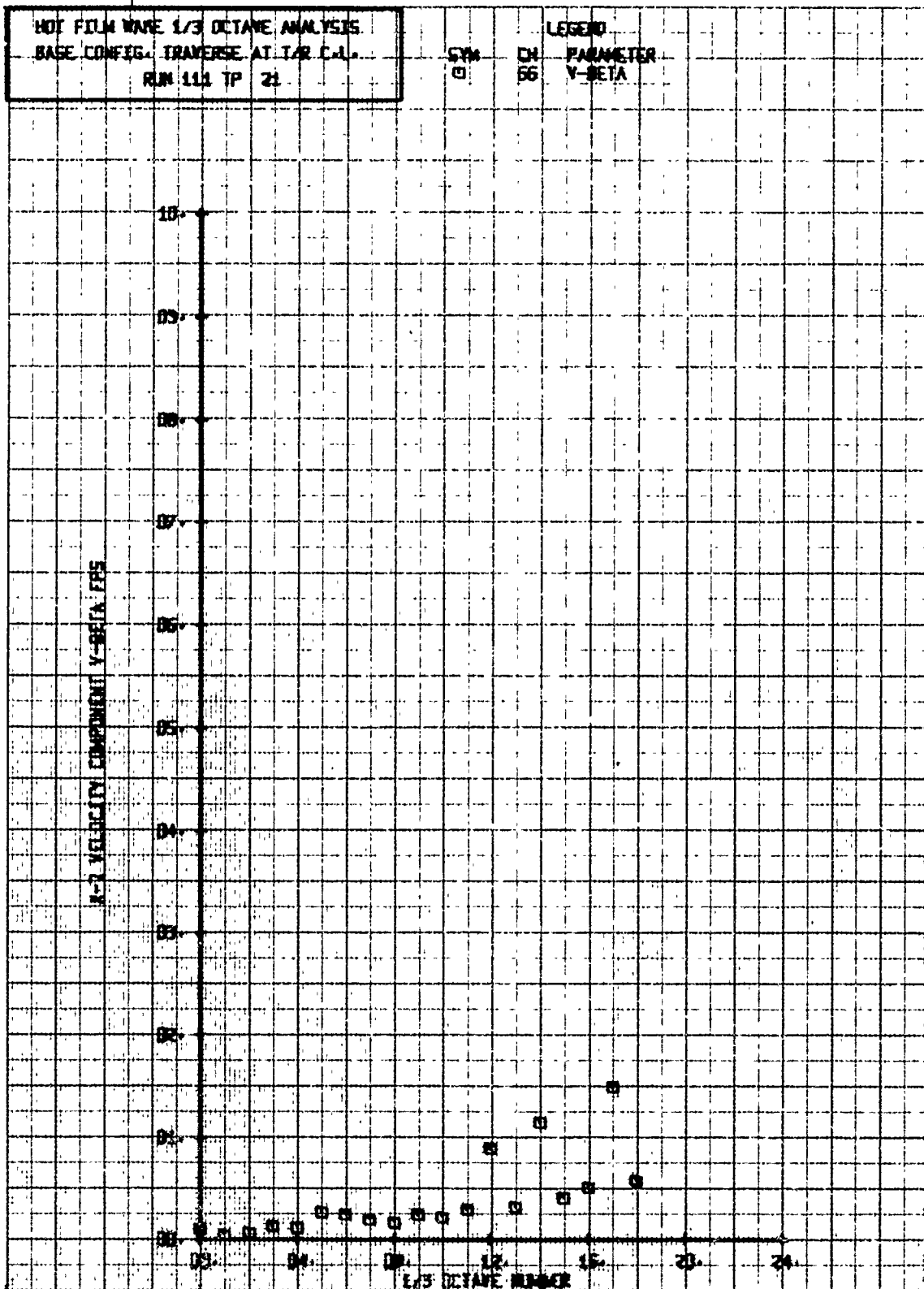


HOT FILM WAKE 1/3 OCTAVE ANALYSIS  
 BASE CONFIG. TRAVERSE AT 1/4 C.I.  
 RUN 111 TP 20

SYM CH  
 0 66  
 PARAMETER  
 V-BETA

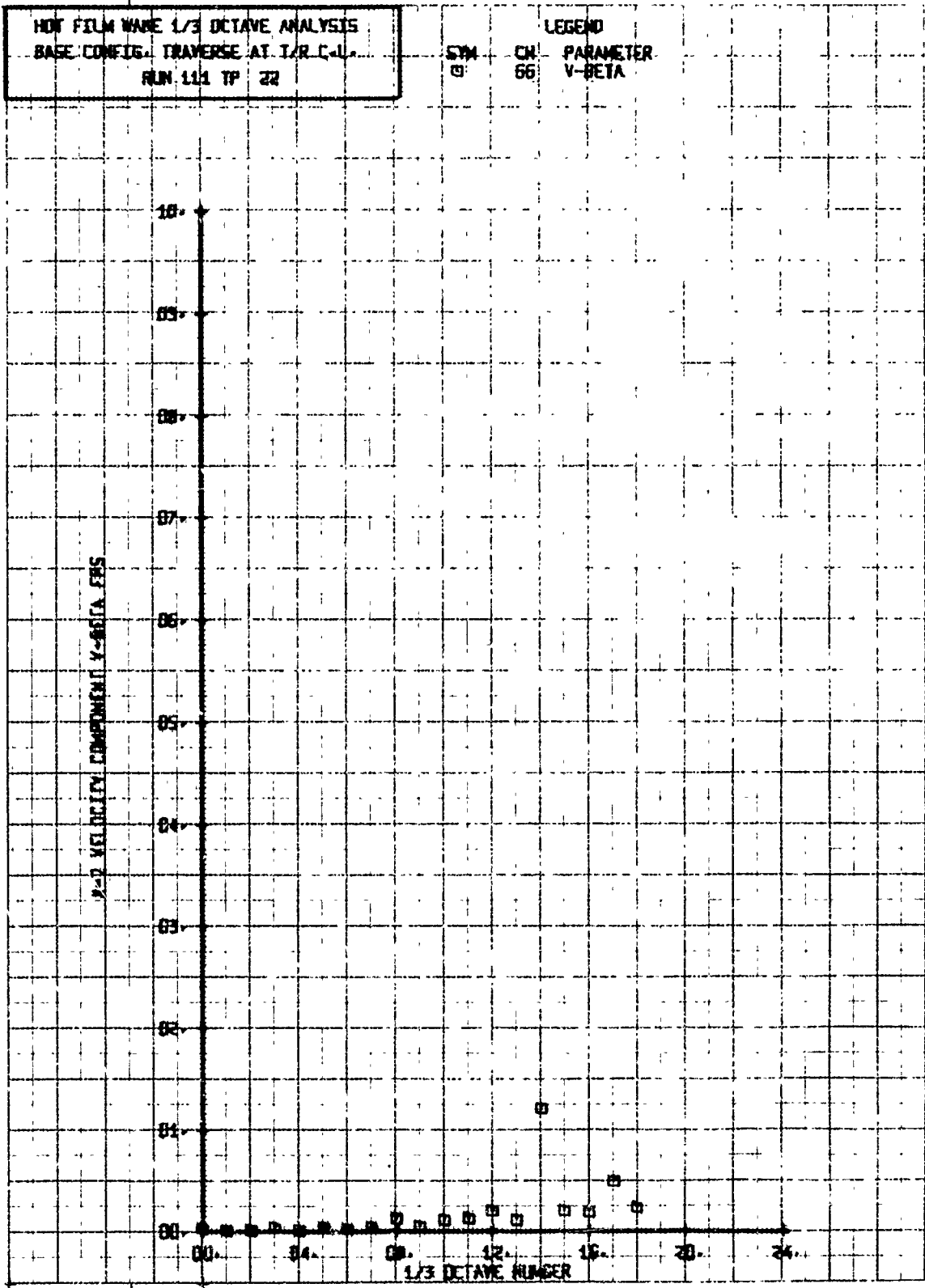
LEGEND  
 V-BETA

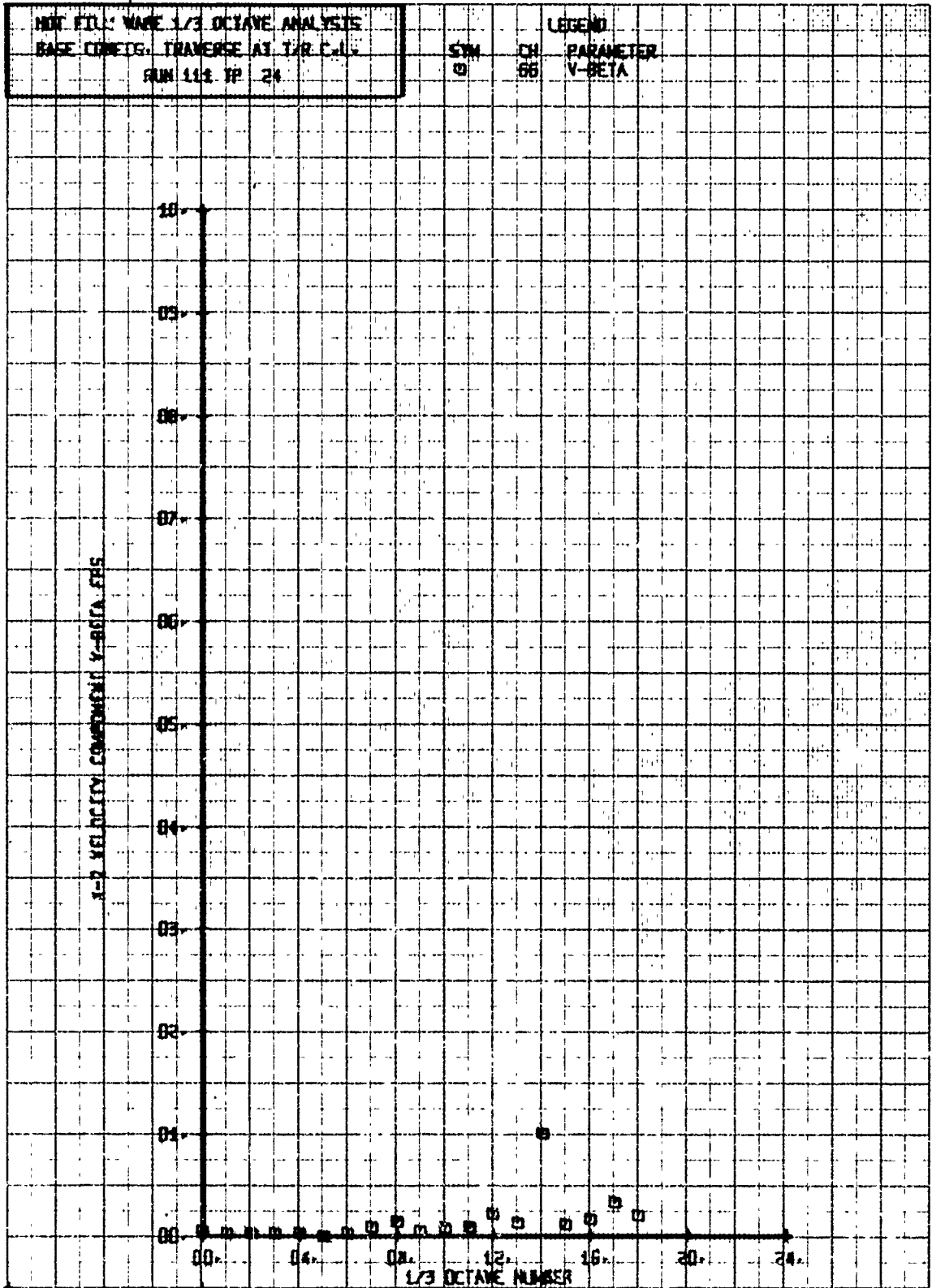


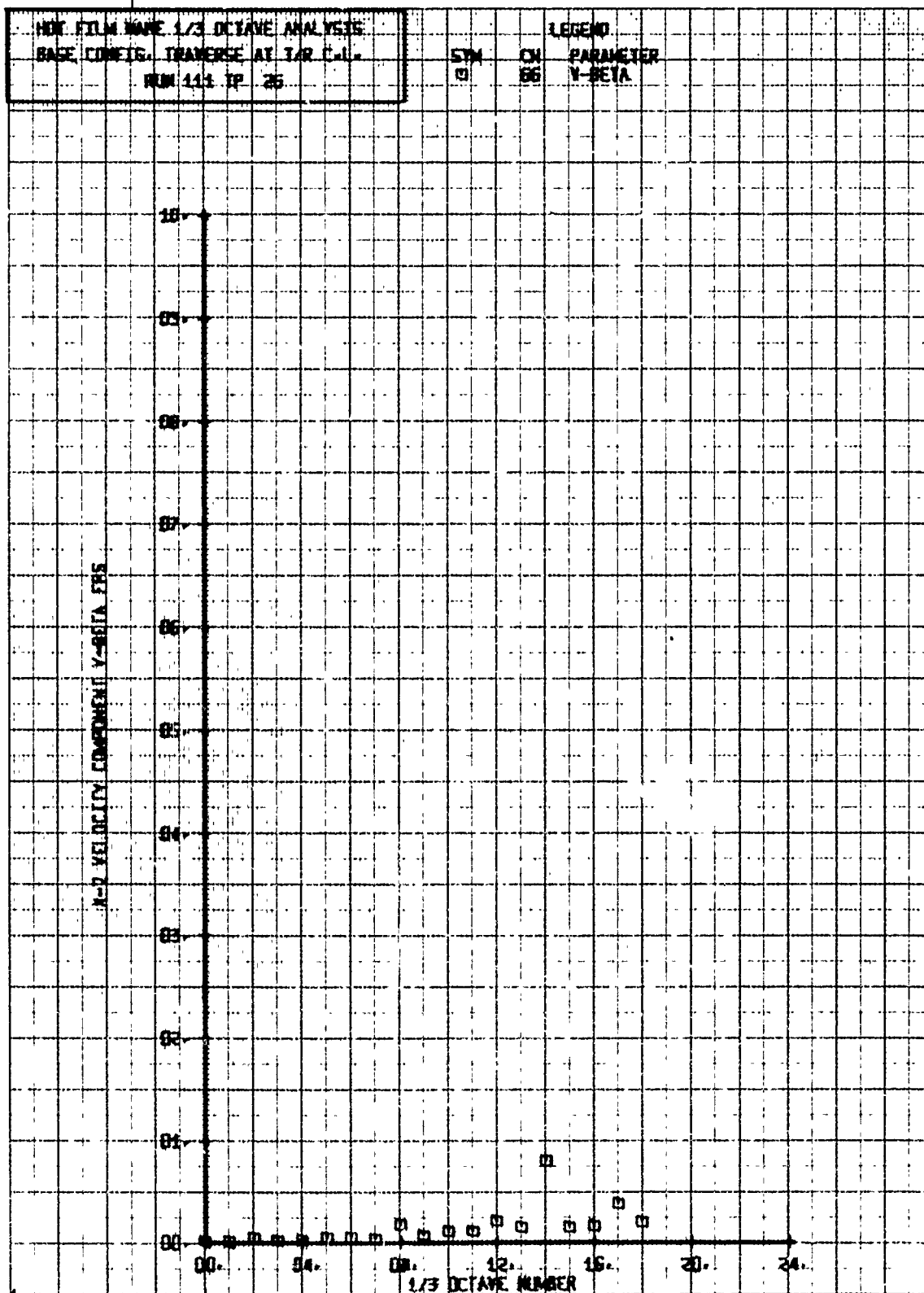


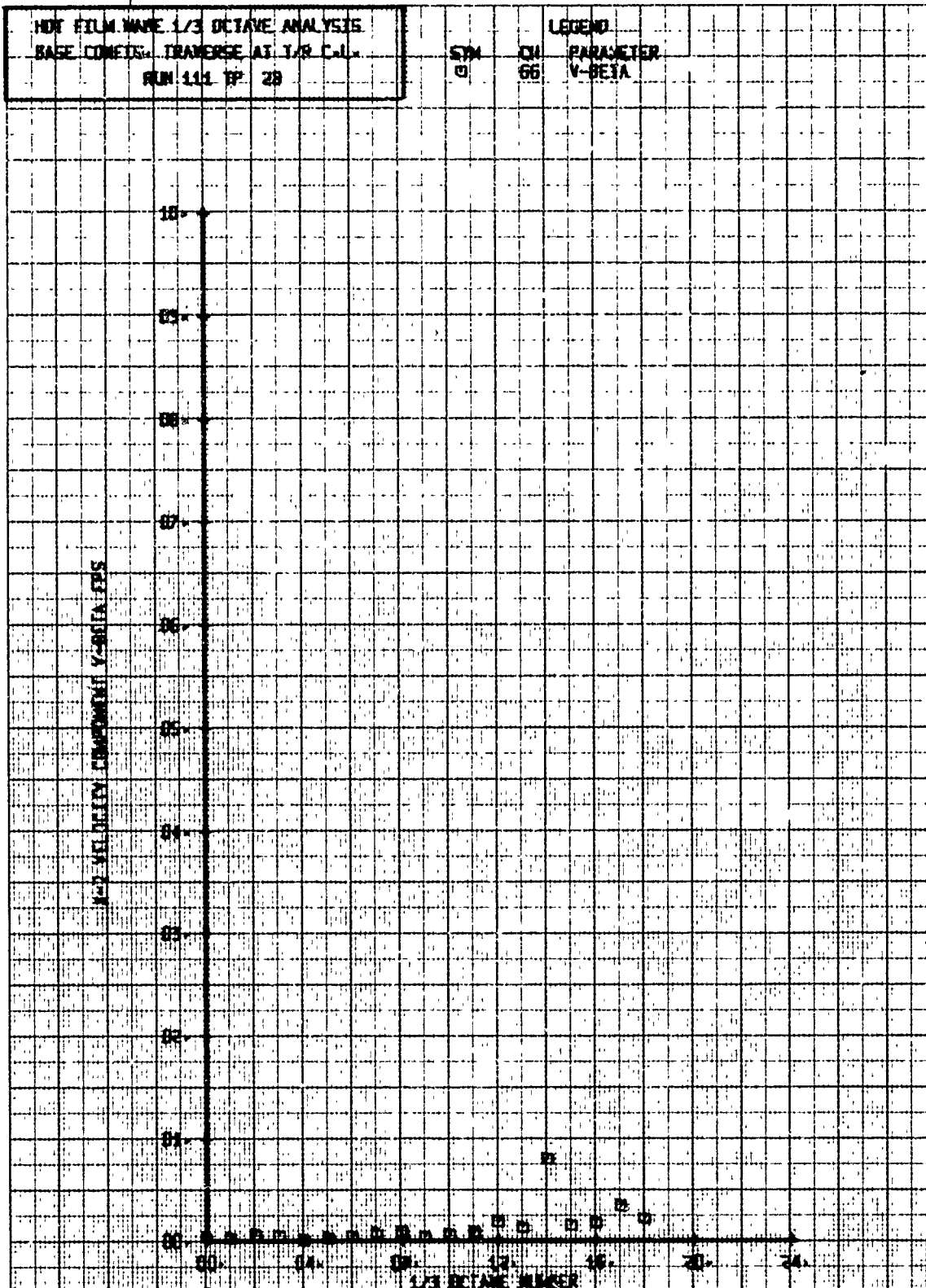
HOT FILM WARE 1/3 OCTAVE ANALYSIS  
 BASE CONFIG. TRAVERSE AT 1/R C-L  
 RUN 111 TP 22

SYM CH PARAMETER  
 0 66 V-BETA





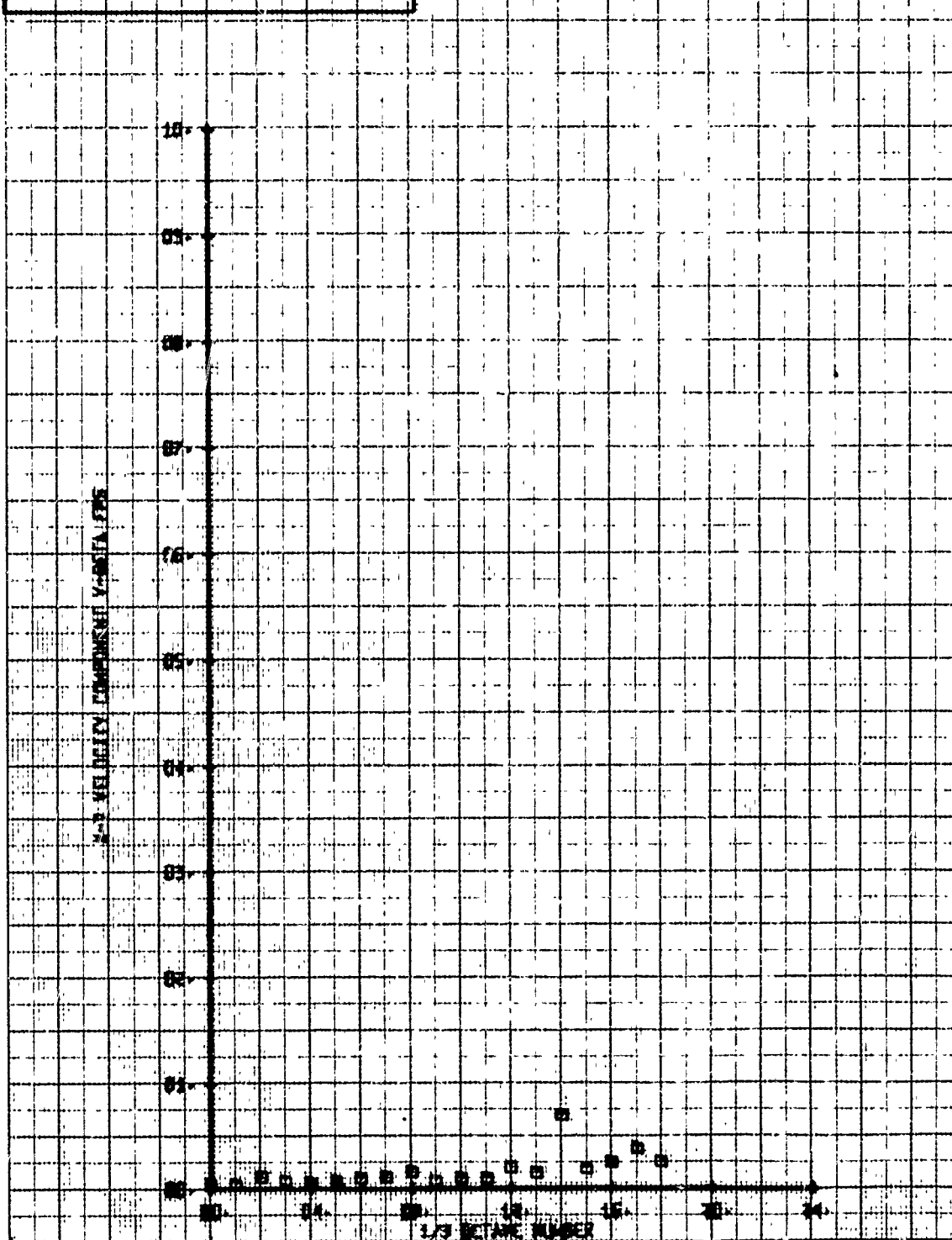




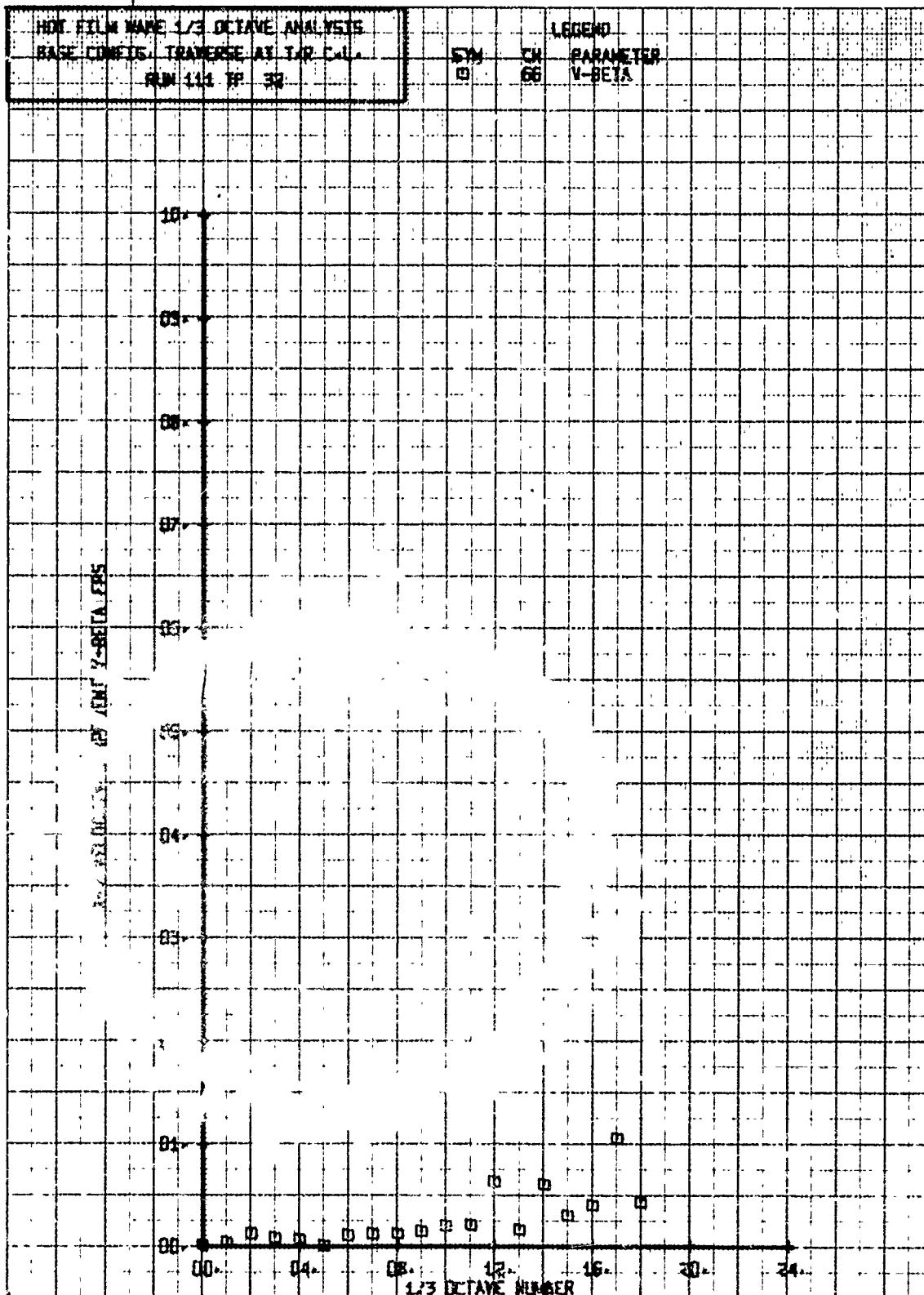
NOV FILM NAME 1/3 OCTAVE ANALYSIS  
 BASE CORRECTION TRANSVERSE AT 140 C.I.  
 RUN 111 PP 30

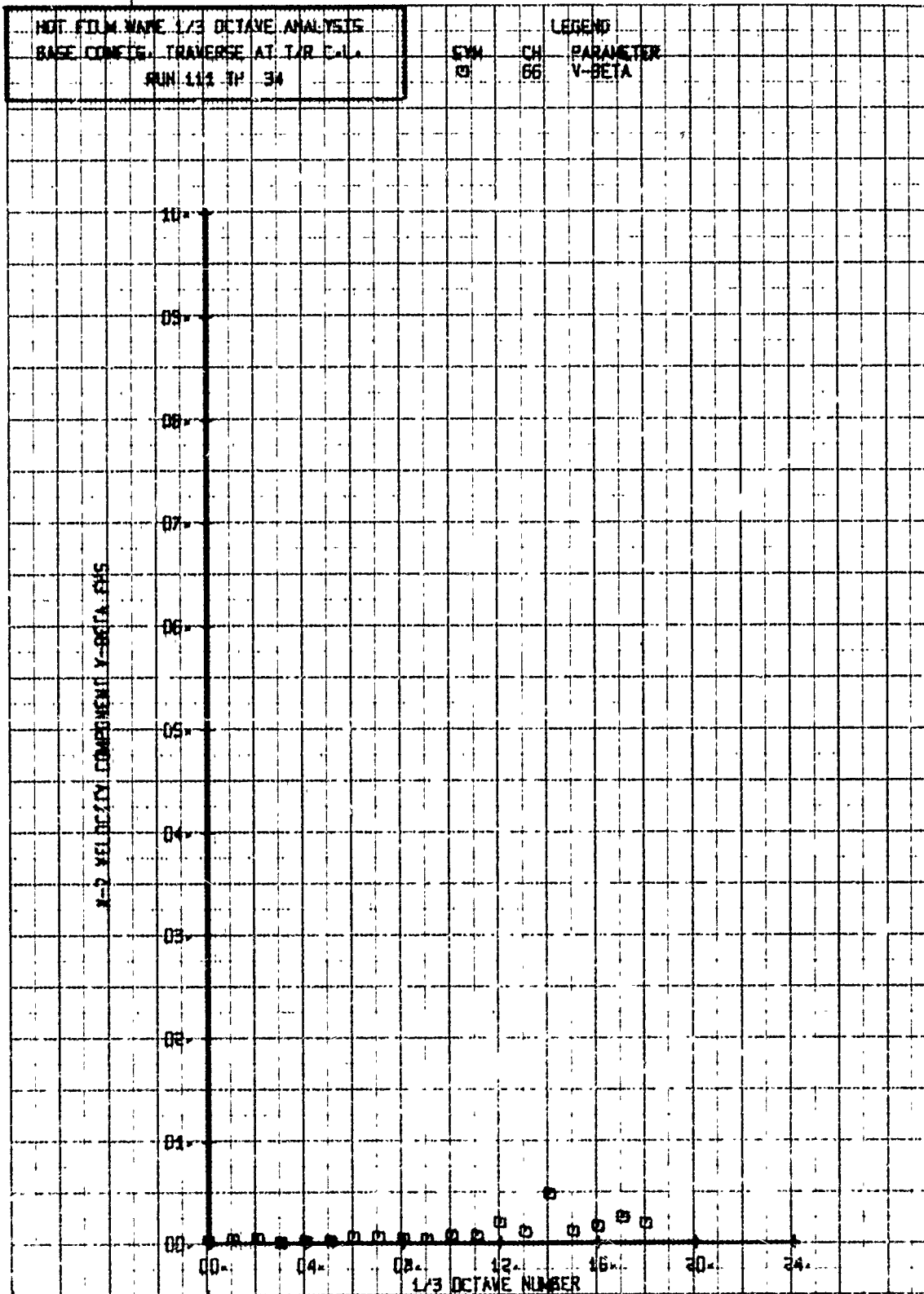
SYN CH PARAMETER  
 0 66 V-BETA

1/3 VELOCITY COMPONENT V-BETA/FPS



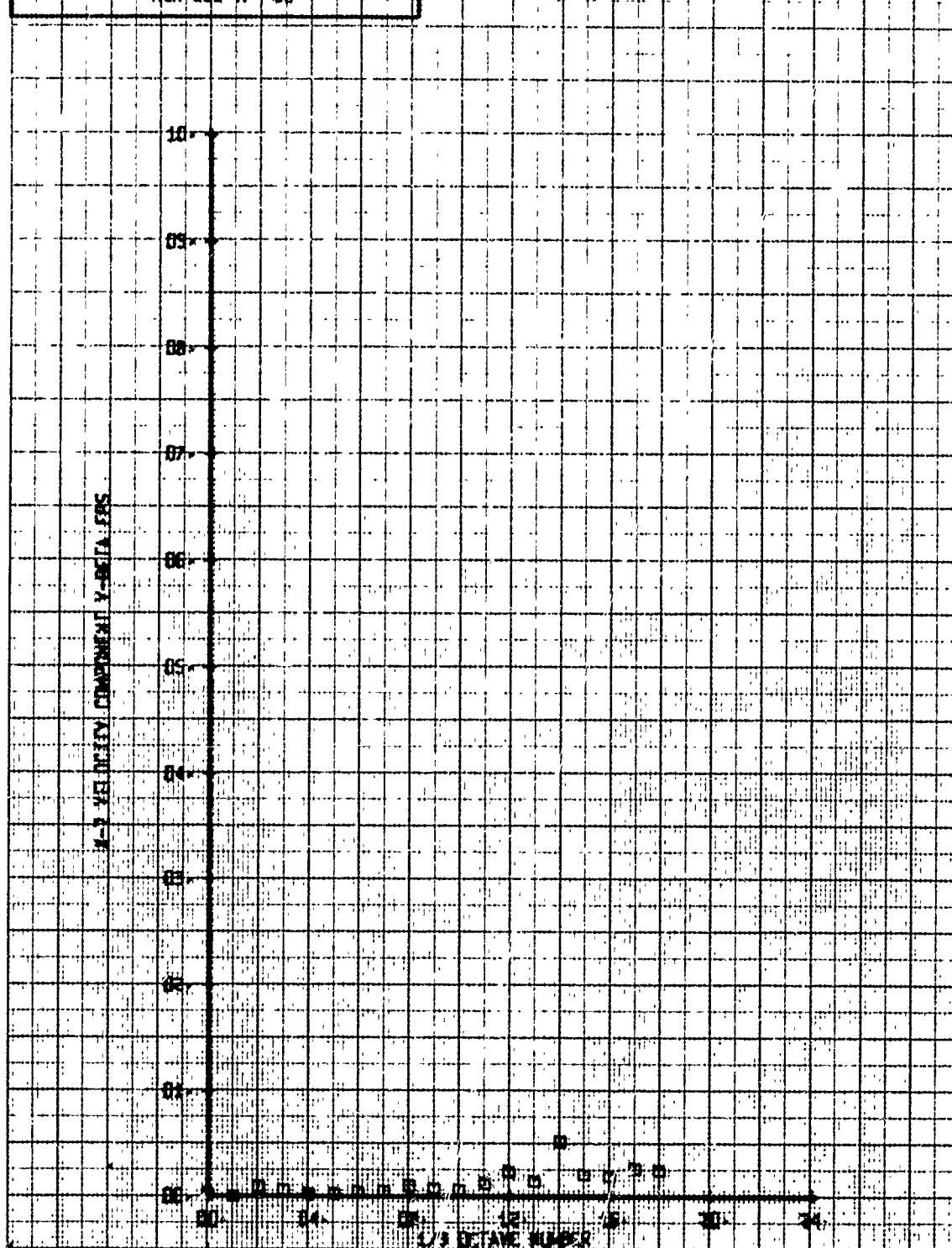


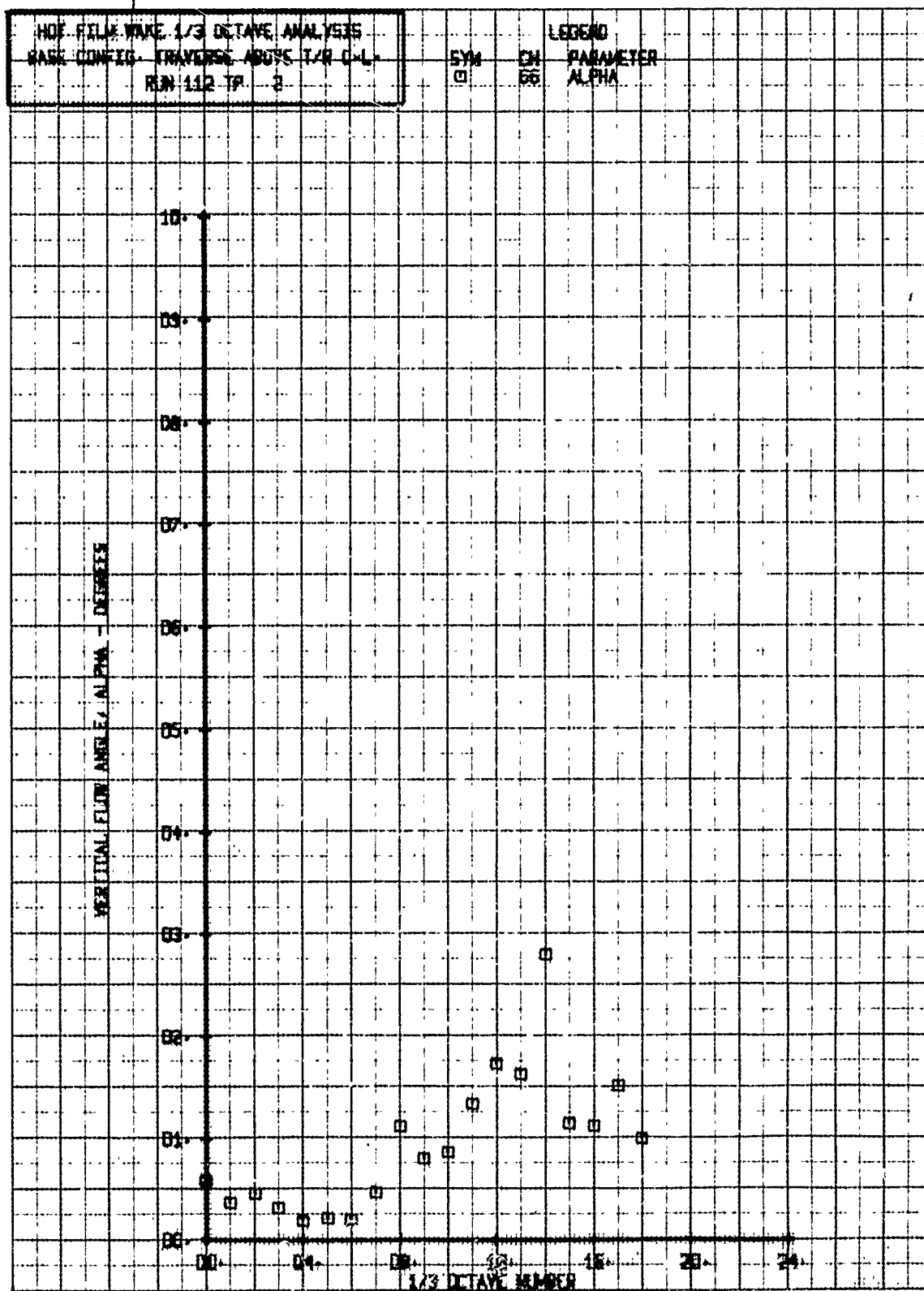


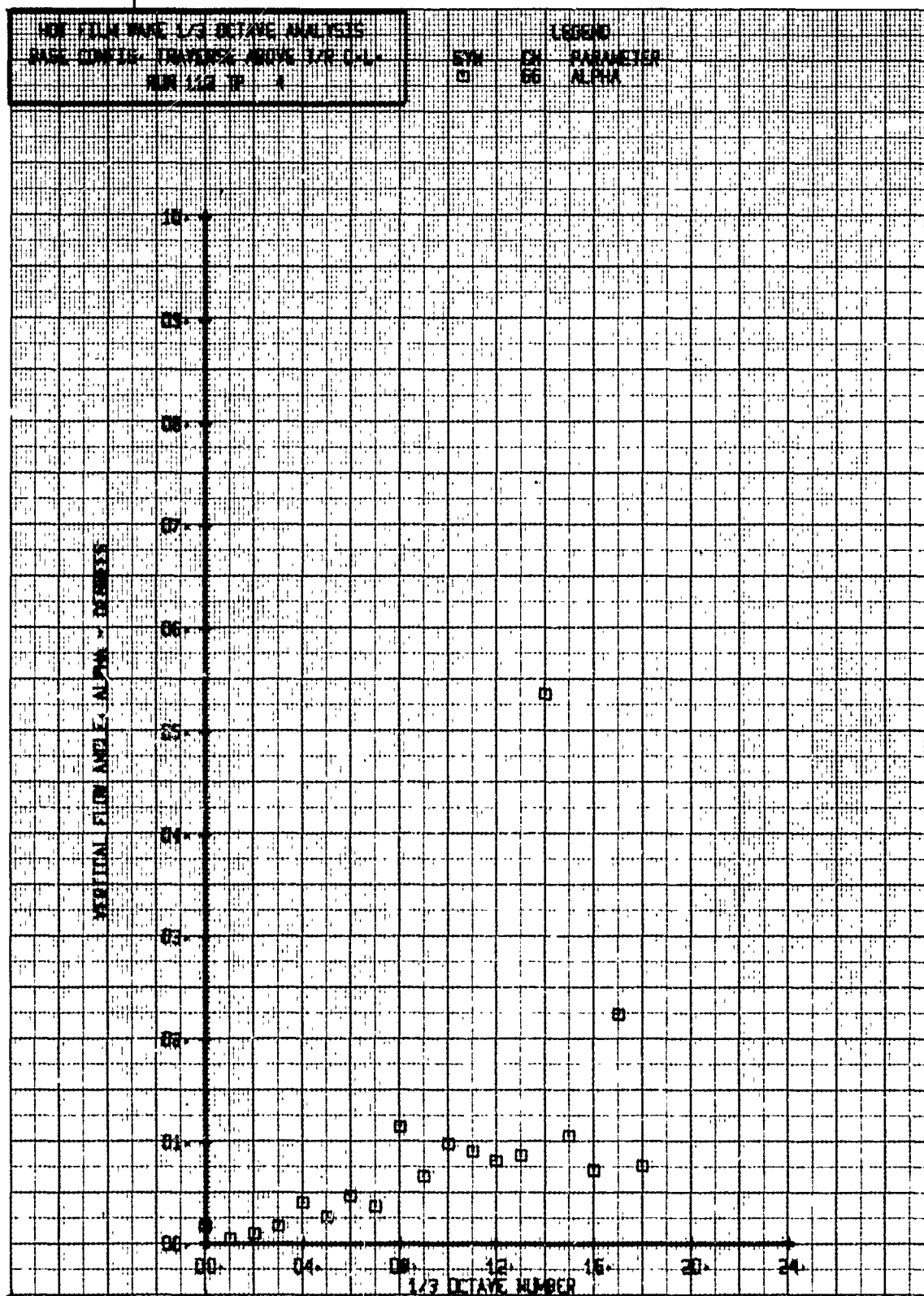


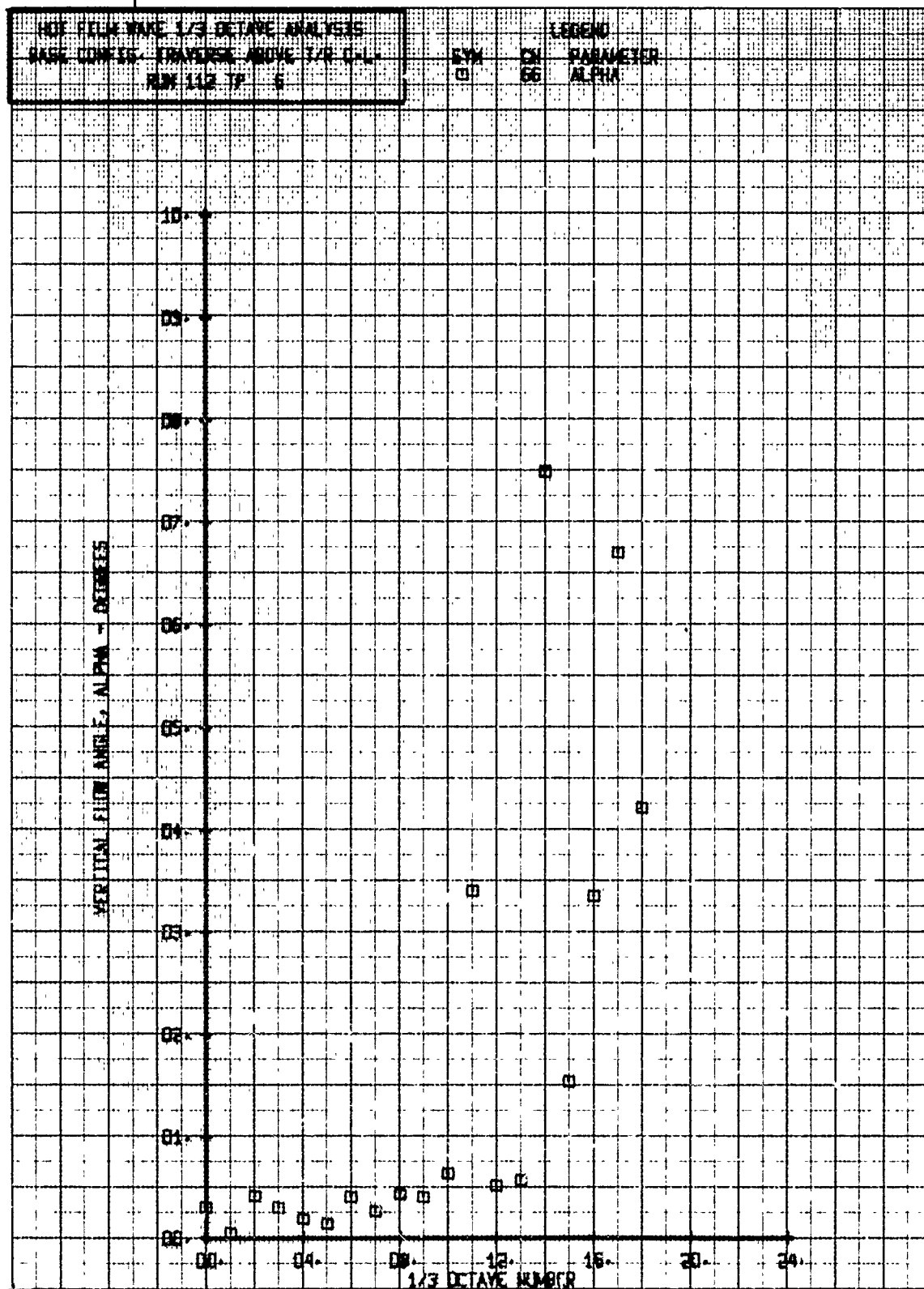
HOT FILM WAVE 1/3 OCTAVE ANALYSIS  
 BASE CONFIG. TRANSVERSE AT T/R C.U.  
 RUN 111 TP. 36

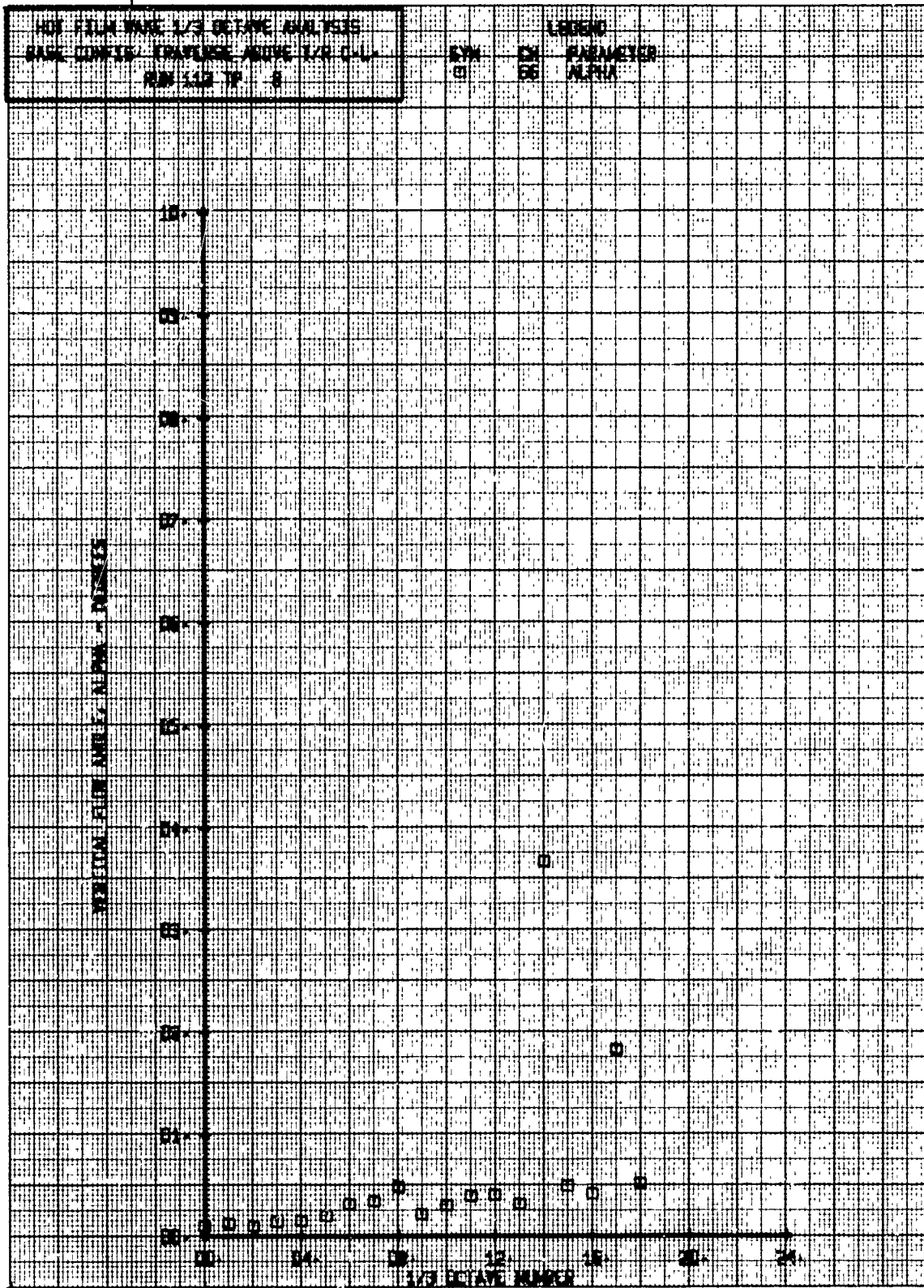
| LEGEND    |    |
|-----------|----|
| SYM       | CH |
| □         | 66 |
| PARAMETER |    |
| V-BETA    |    |





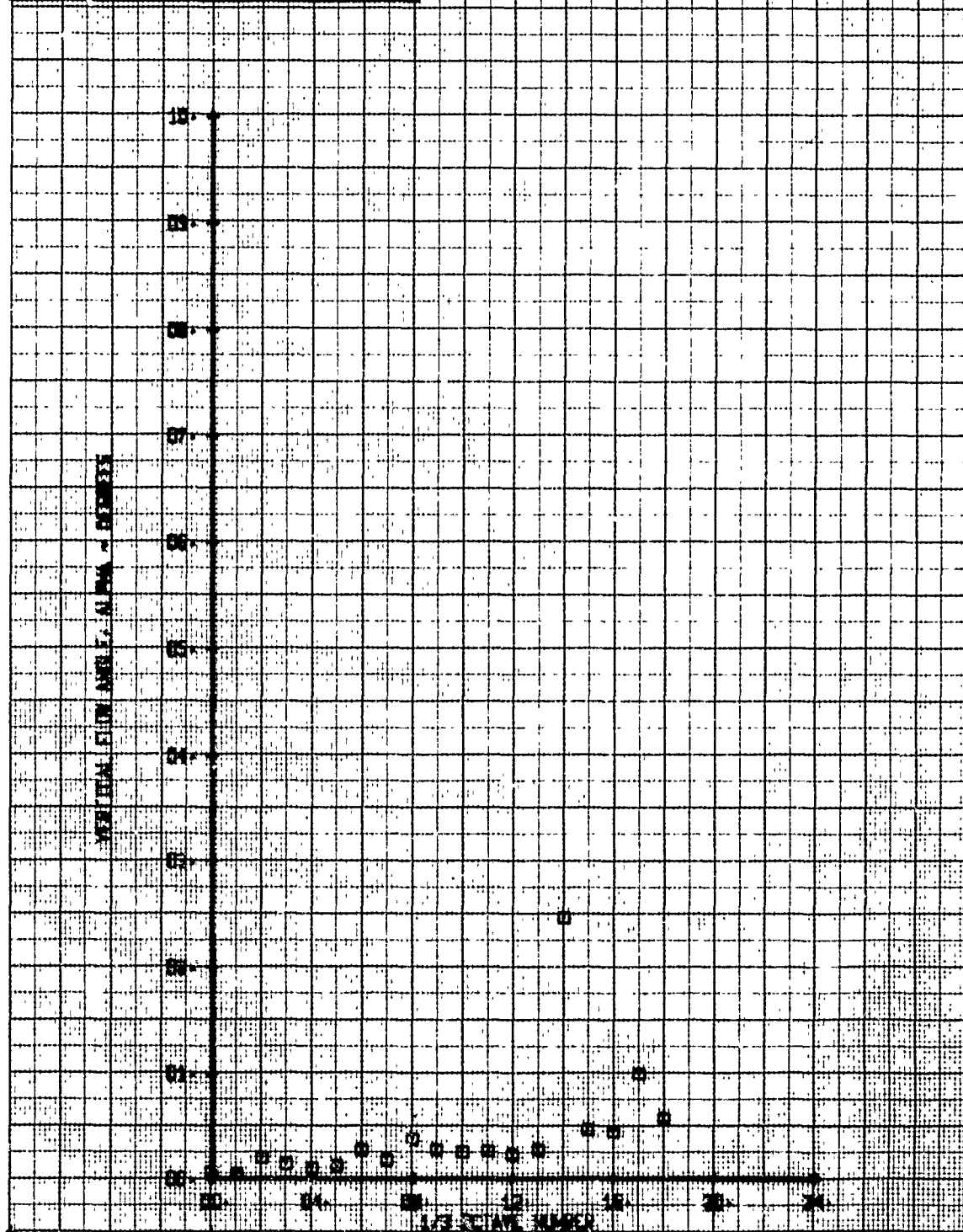




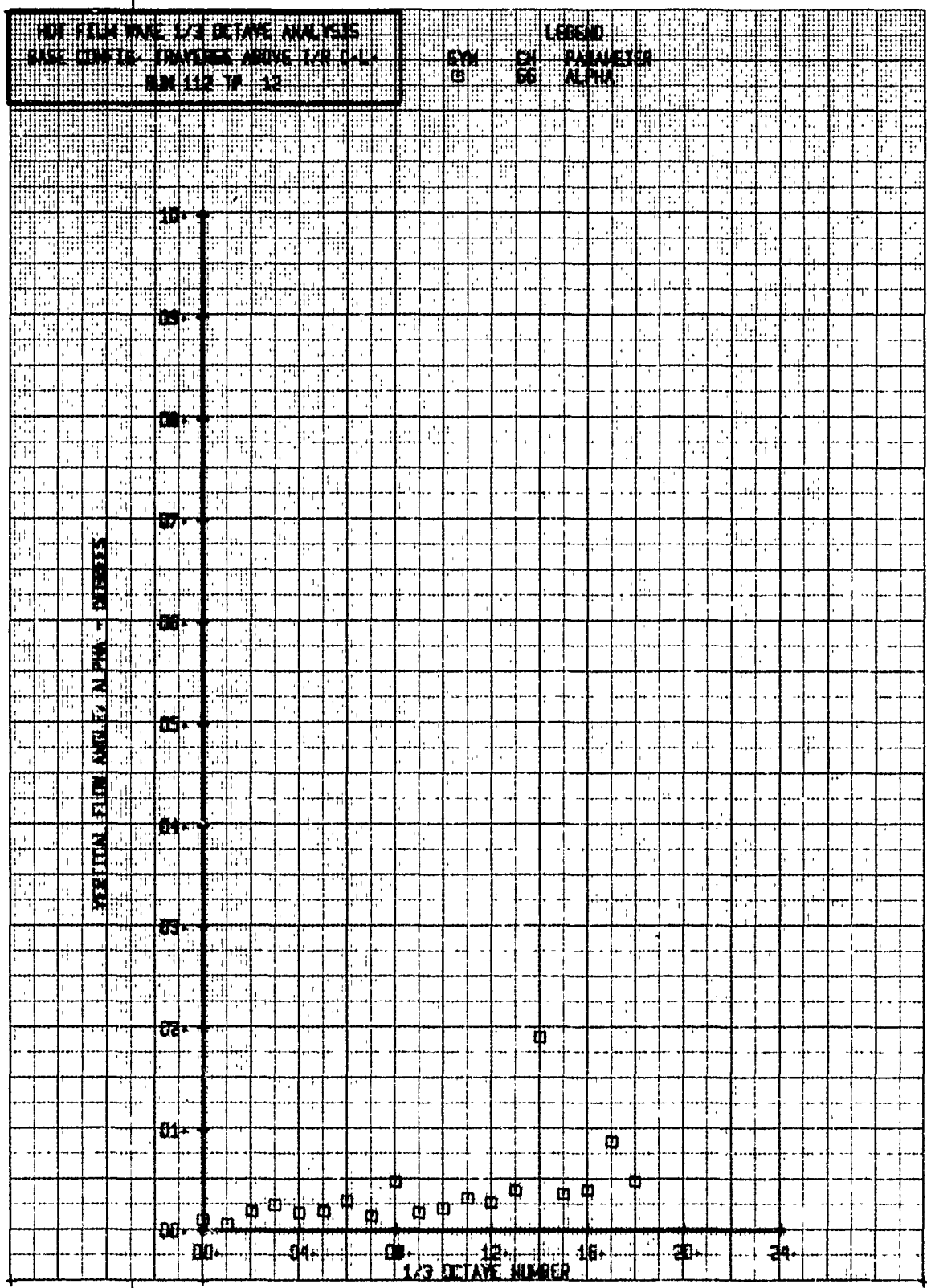


HON FILM WAVE 1/3 OCTAVE ANALYSIS  
 BASE CONSID. TRAVERSE ABOVE 1/2 D-L  
 RUN 112 F 20

LEGEND  
 CH 66  
 PARAMETER  
 ALPHA



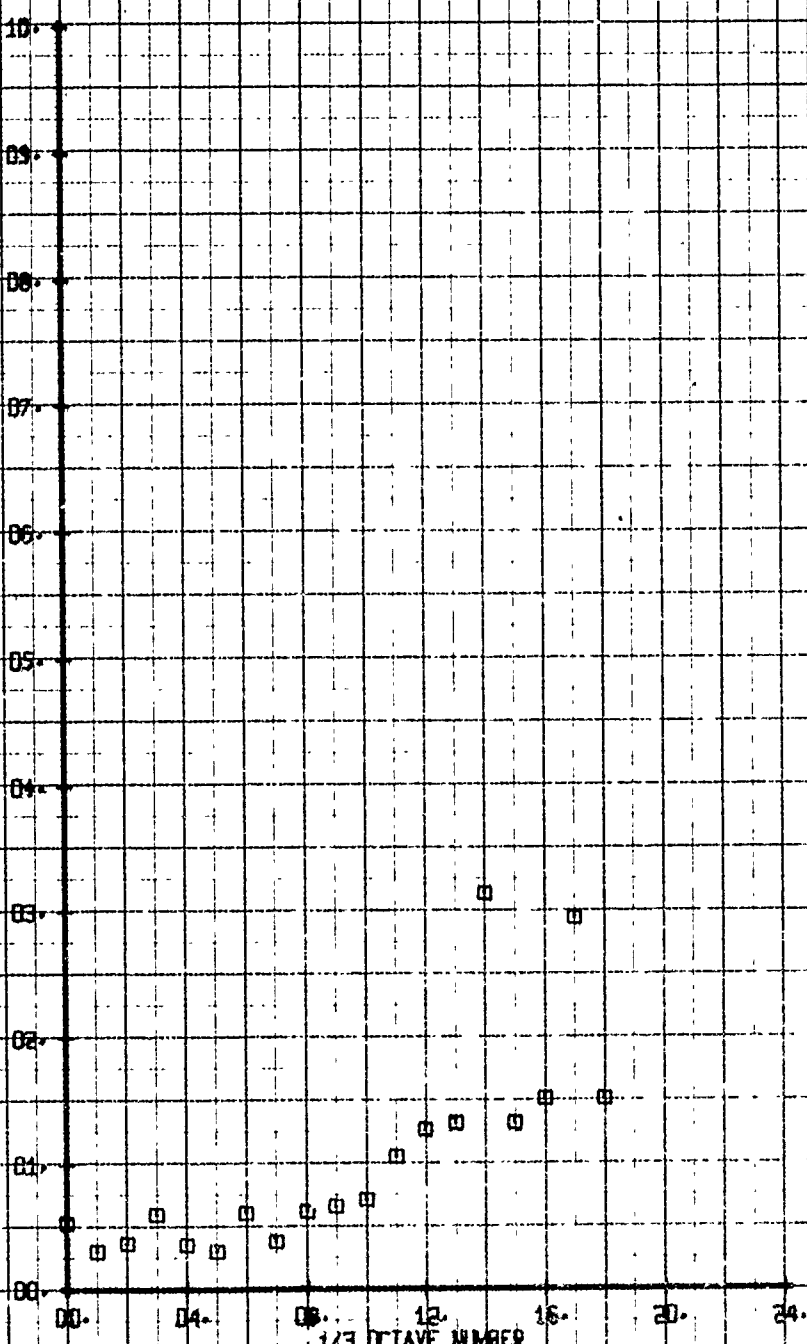


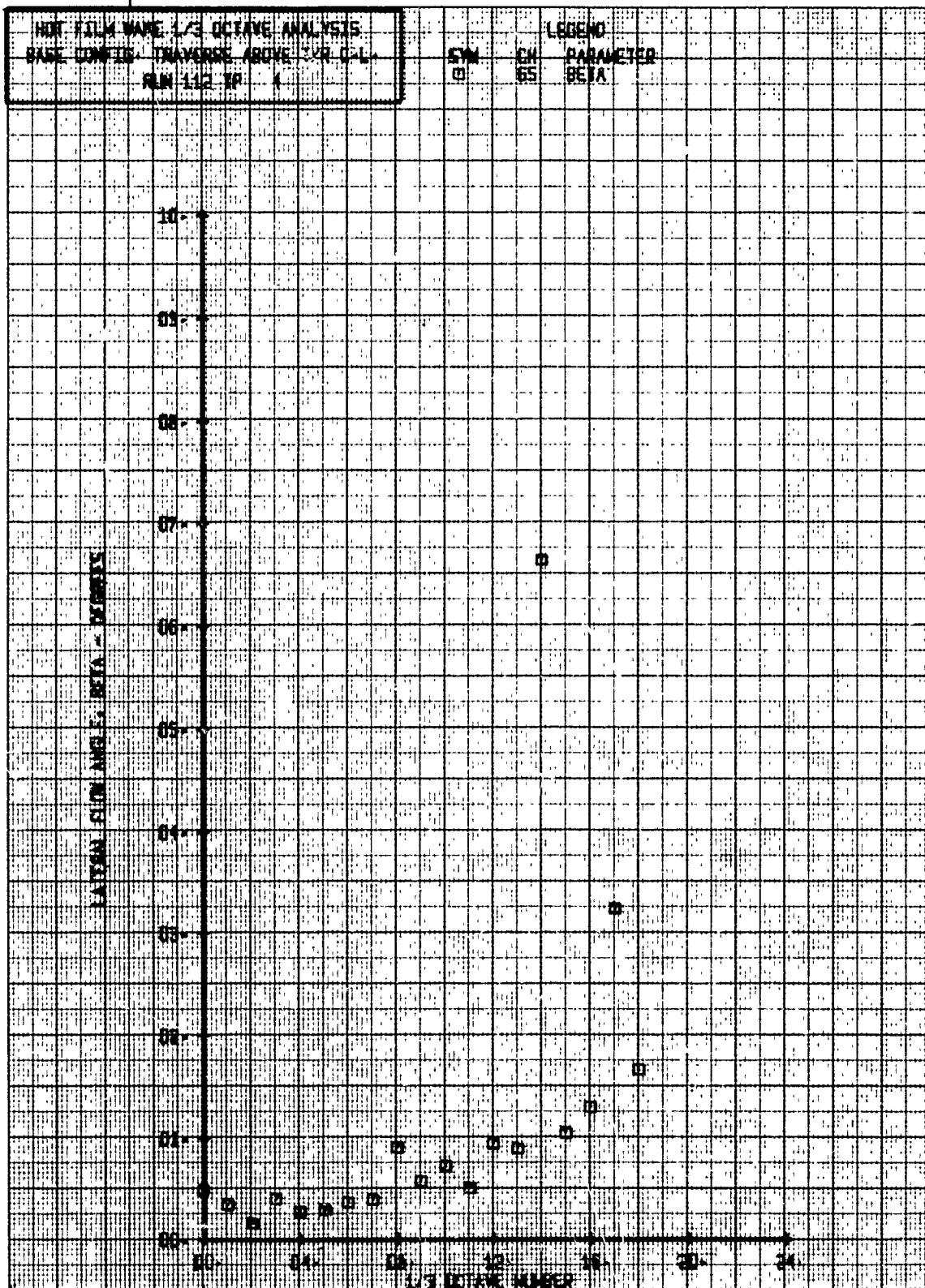


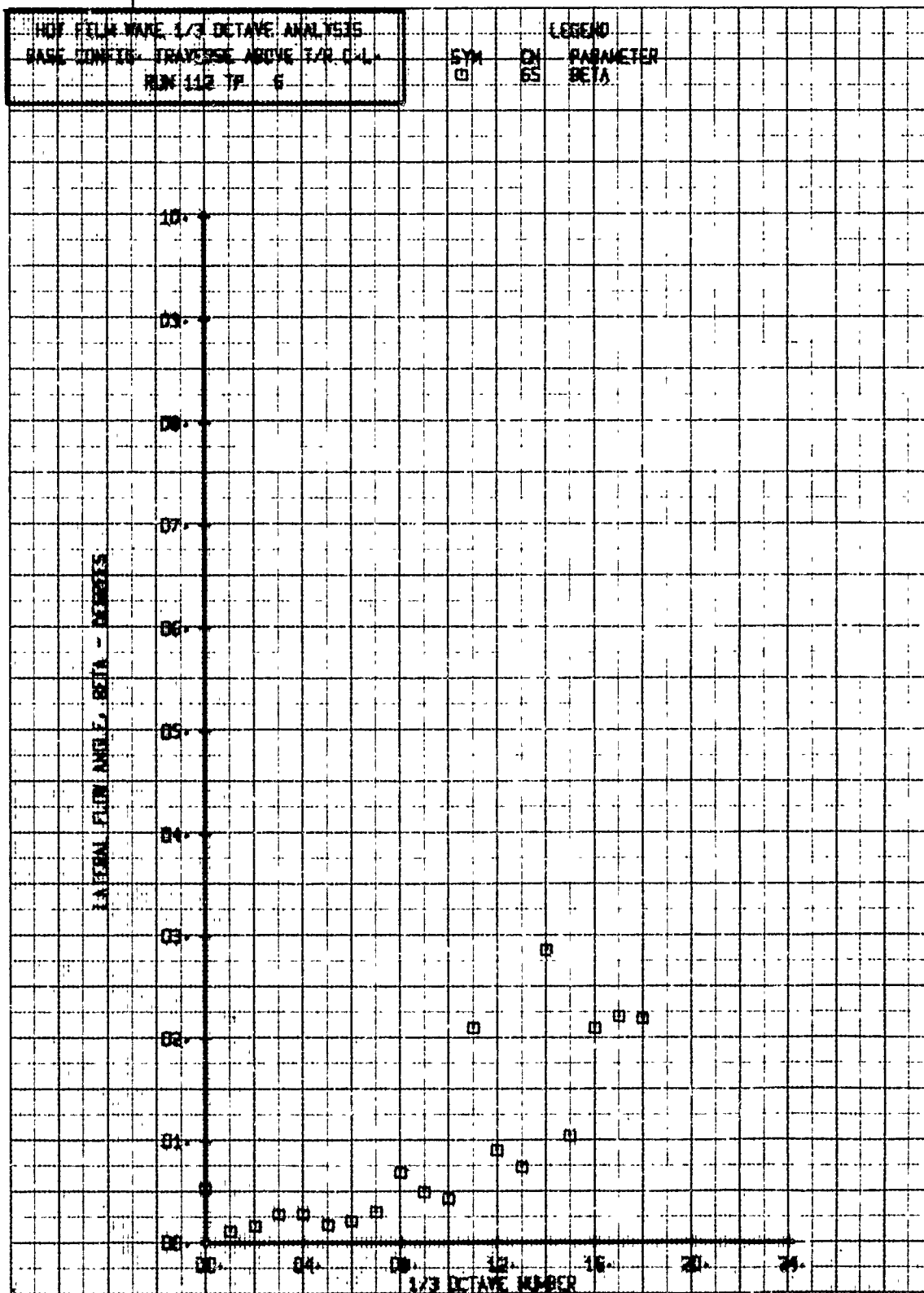
HOT FILM WAKE 1/3 OCTAVE ANALYSIS  
 BASE CONDITION: TRANSVERSE ABOVE T/R C-L  
 RUN 112 TP 2

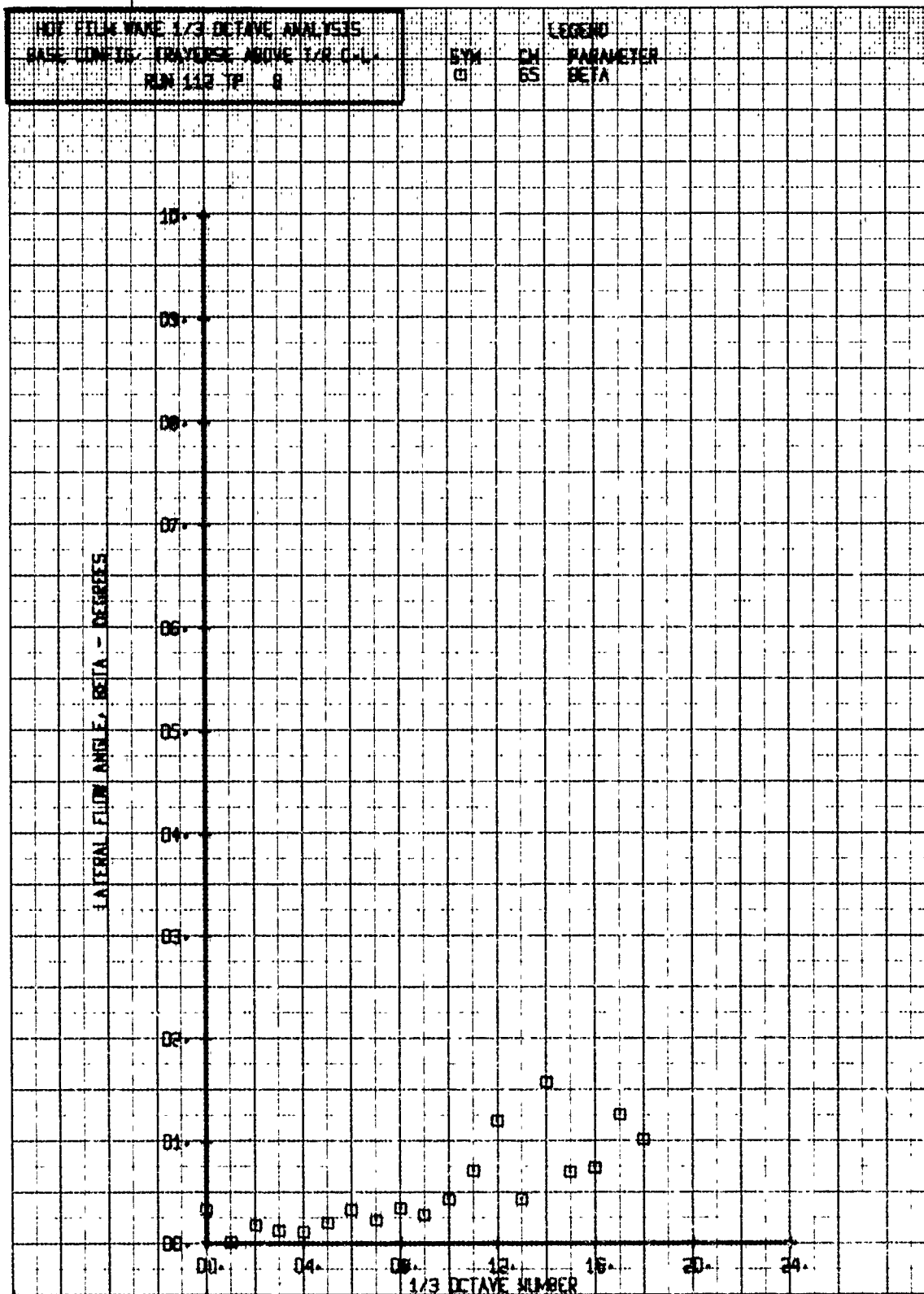
SYM CH PARAMETER  
 □ BS BETA

LATERAL FLOW ANGLE, BETA - DEGREES



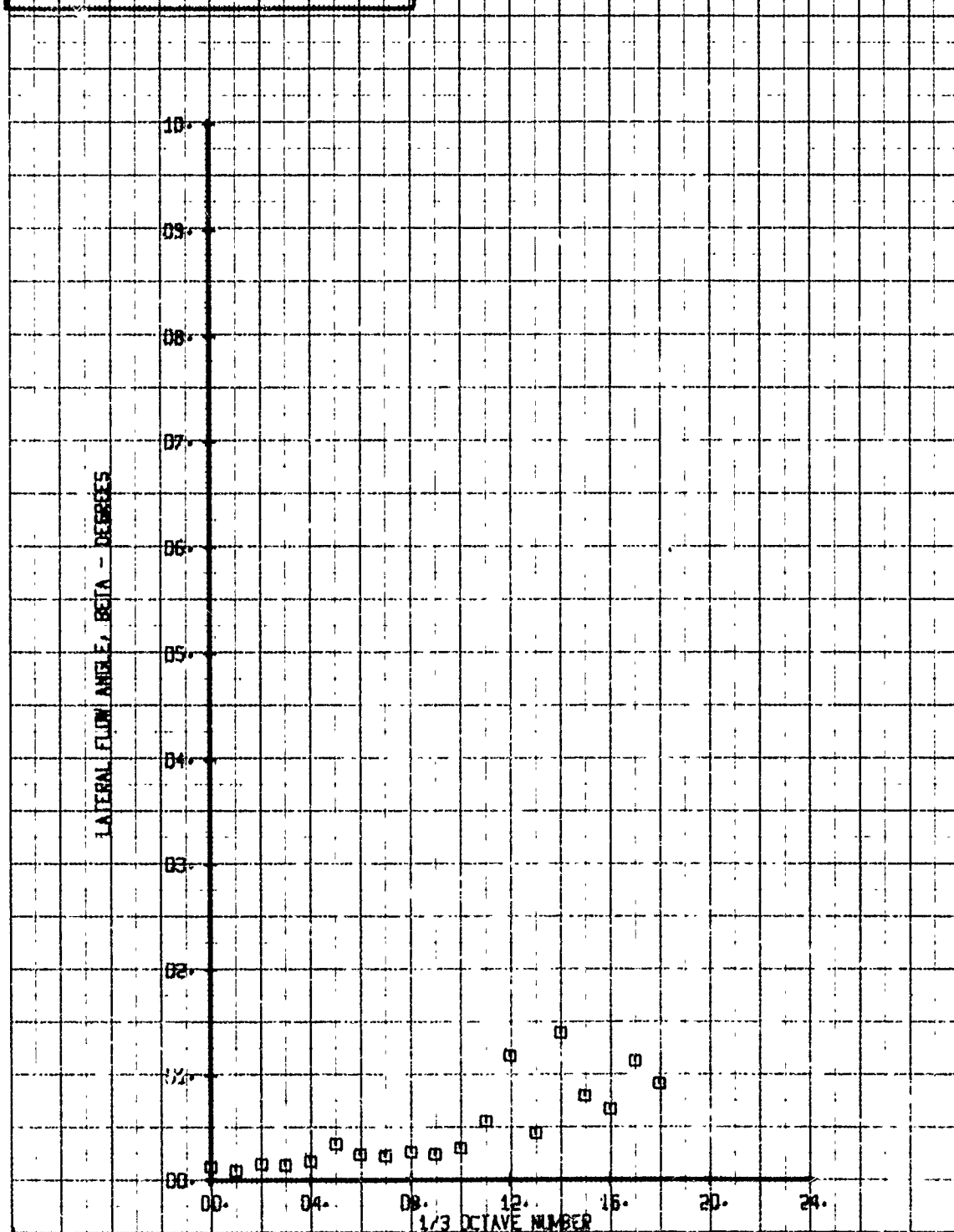






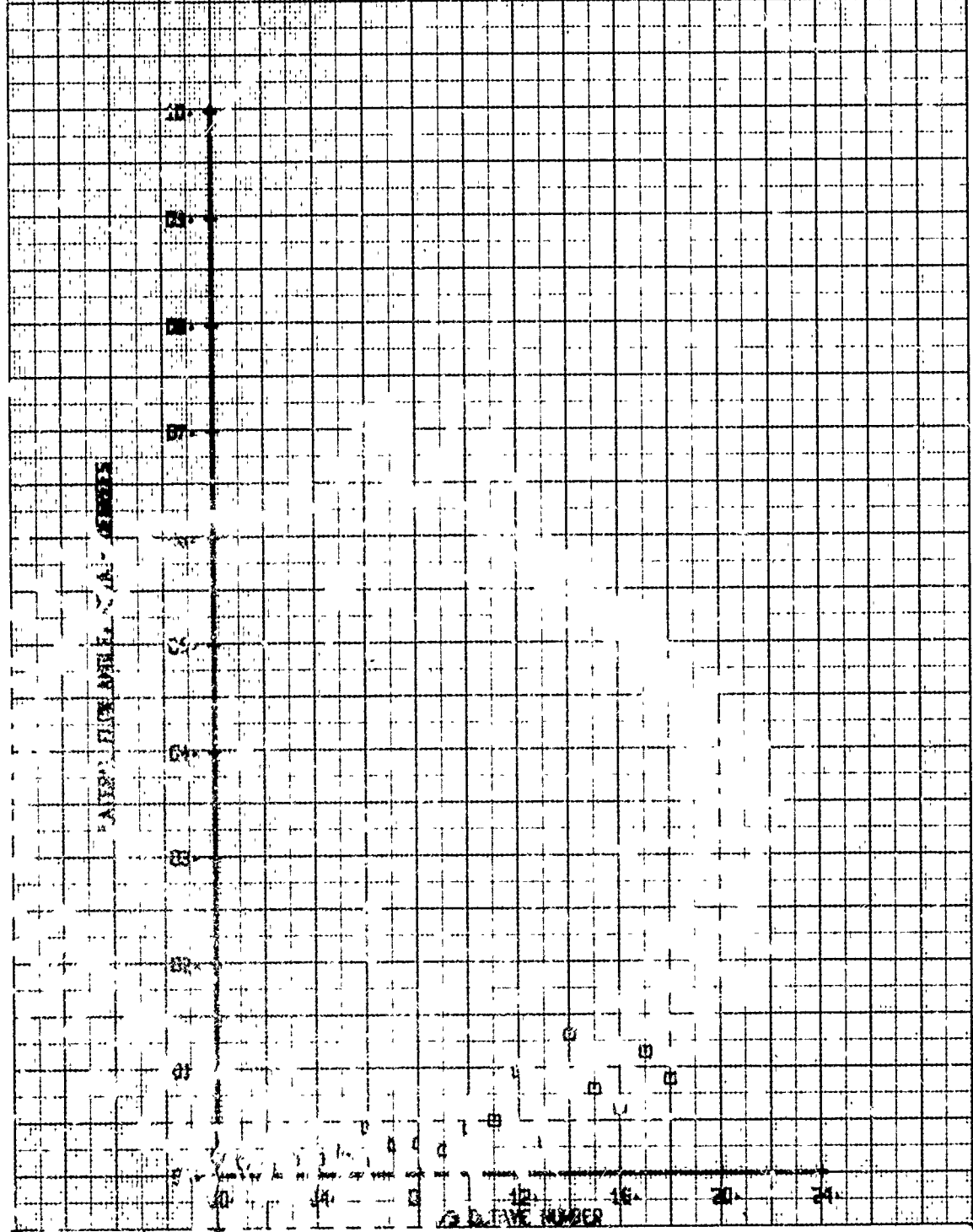
HOT FILA WAKE 1/3 OCTAVE ANALYSIS  
 BASE CONFIG. TRAVERSE ABOVE T-4 C-L  
 RUN 112 TP 10

SYM CH PARAMETER  
 @ 65 BETA



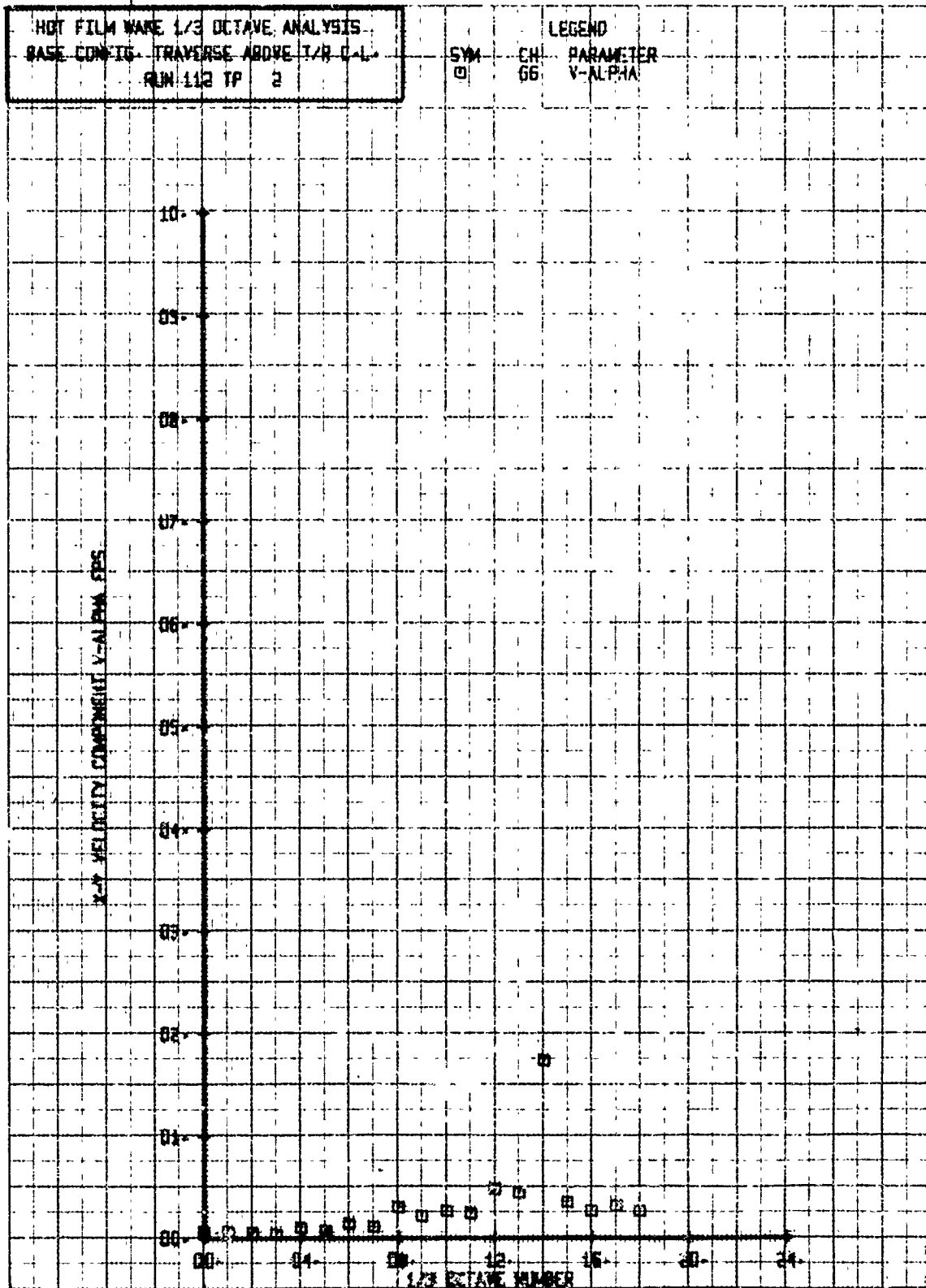
NOV 1964 WAVE 1/3 OCTAVE ANALYSIS  
 BASE 004115 TRAVELT. WAVE 1/3 0-1-1  
 RUN 112 17 27

SYM CH PARAMETER  
 05 05 BETA

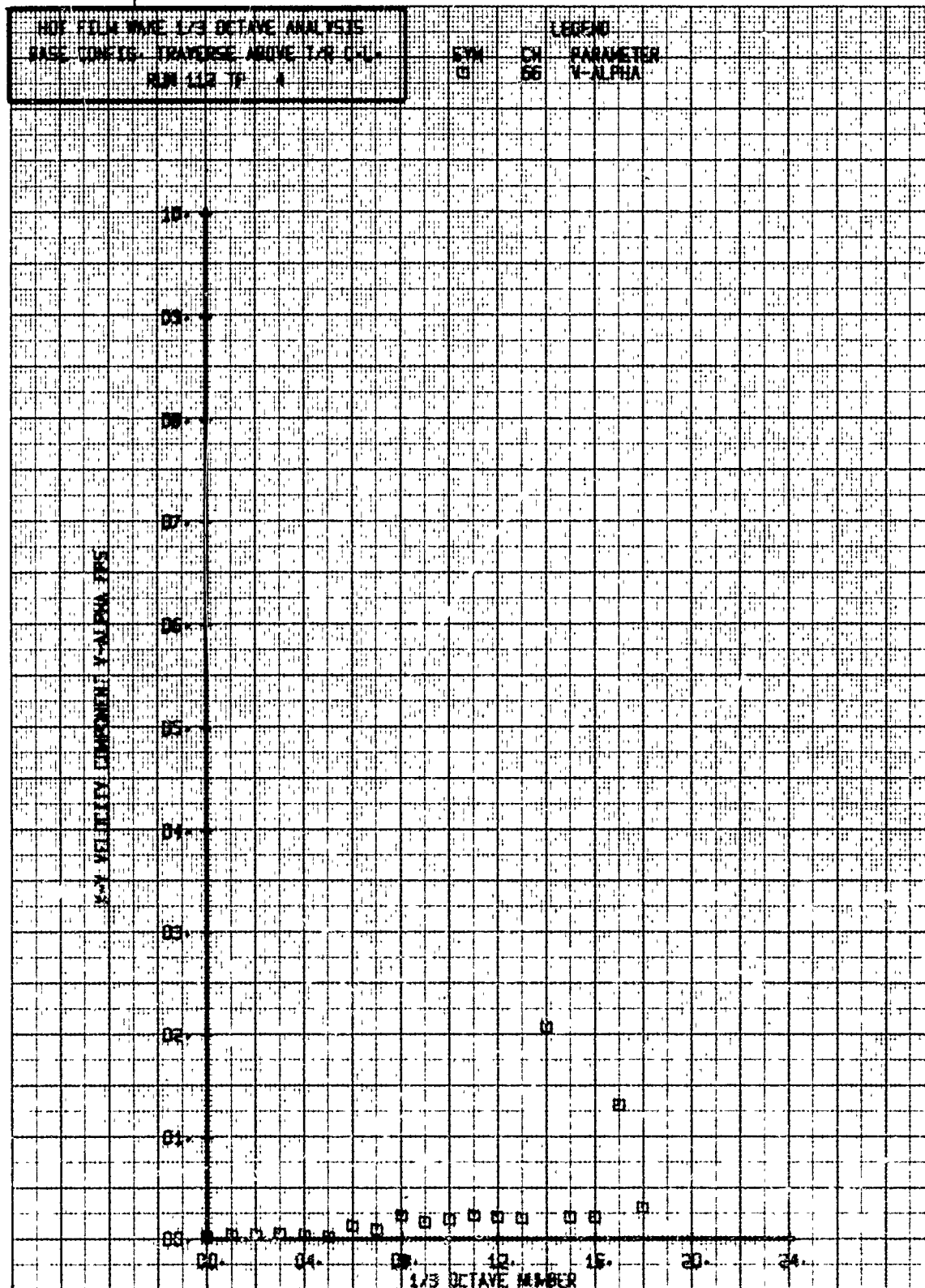


HOT FILM WAKE 1/3 OCTAVE ANALYSIS  
 BASE CONV IS TRAVERSE ABOVE T/R C-L  
 RUN 112 TP 2

SYM CH PARAMETER  
 □ 66 V-ALPHA

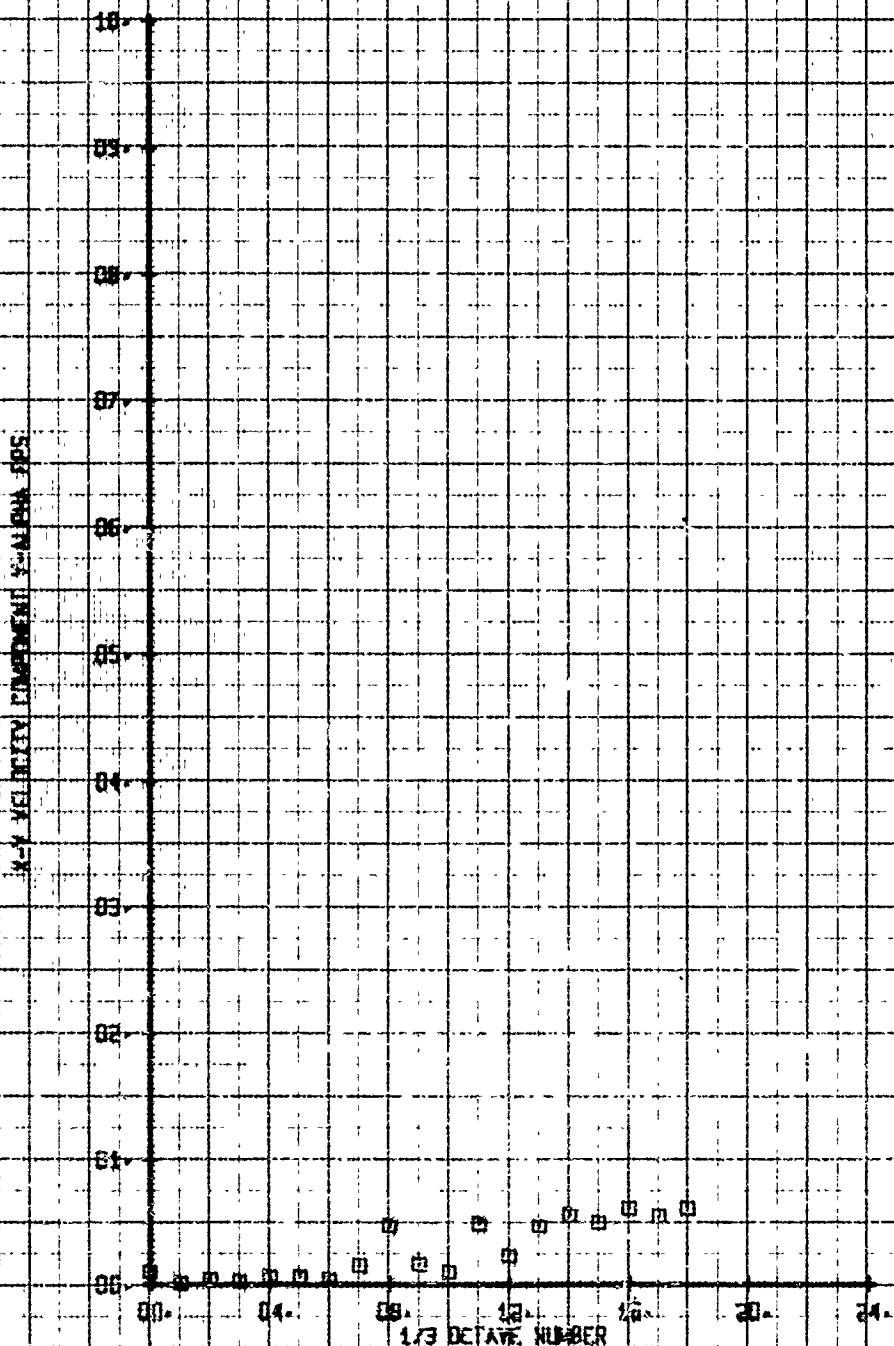






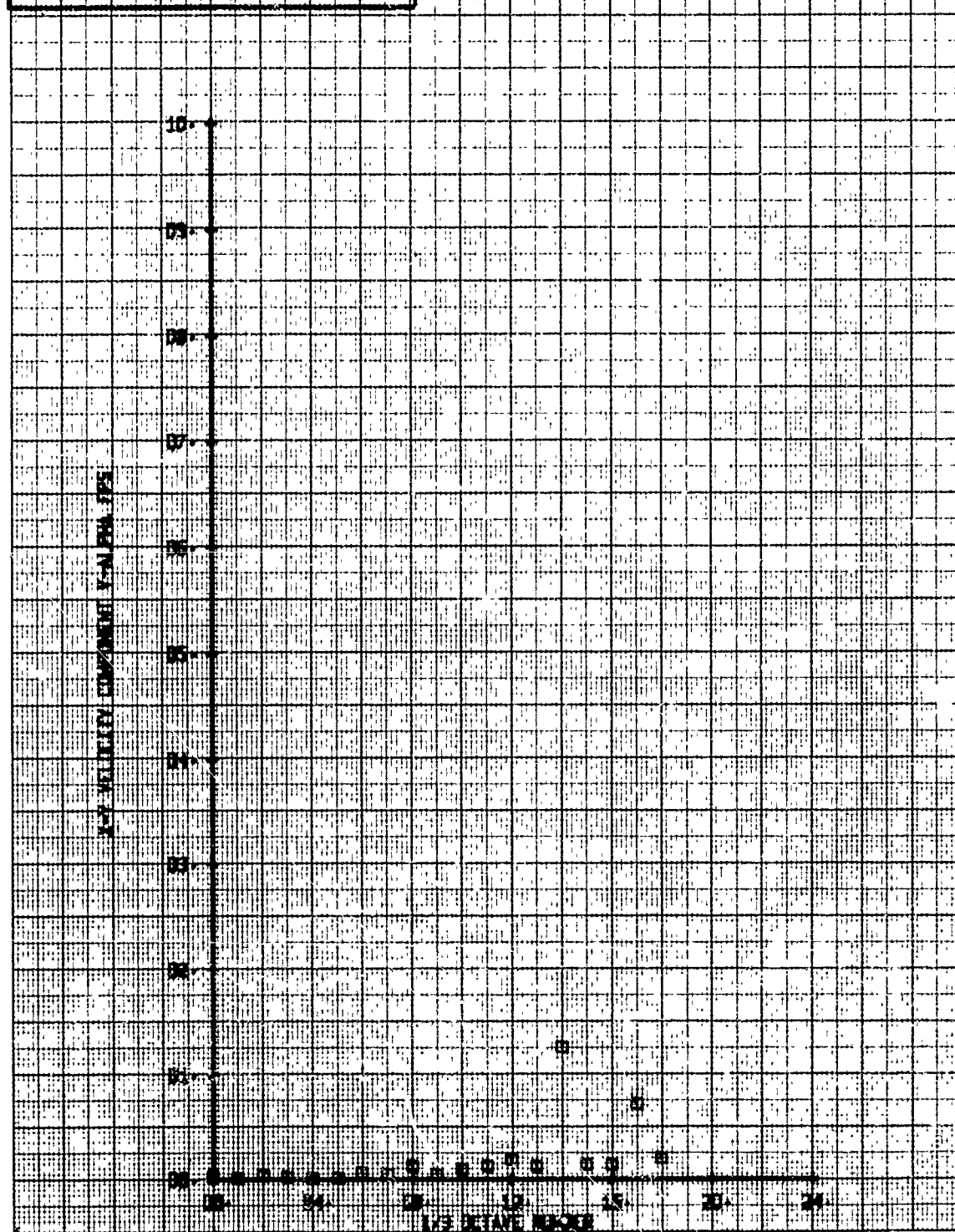
HOT FILM WAVE 1/3 OCTAVE ANALYSIS  
 BASE CORRECTED TRAVERSE ABOVE 1/2 C.L.  
 RUN 112 TP 6

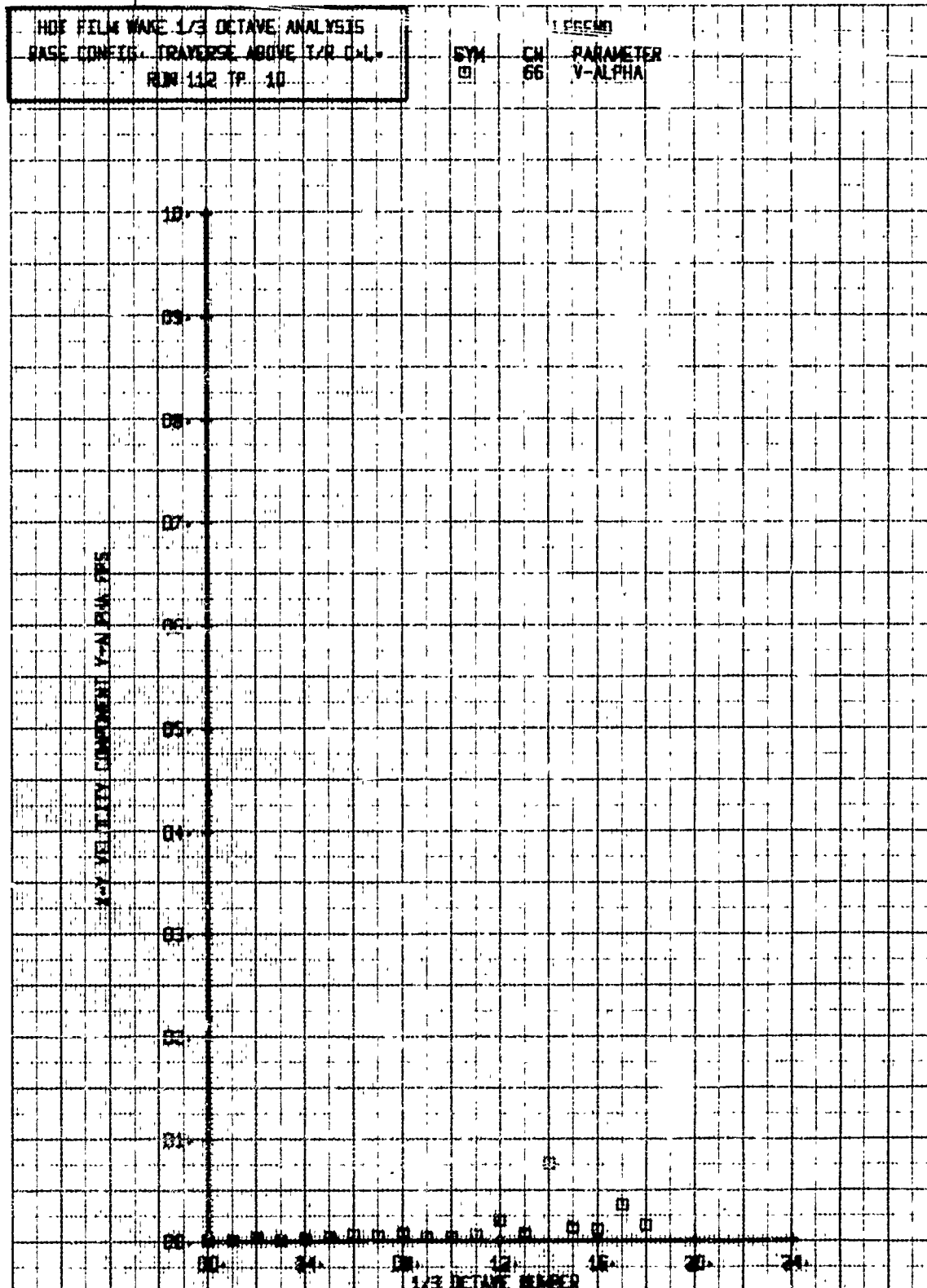
SYN CH  
 01 56  
 PARAMETER  
 V-ALPHA



HOX FILM WAKE 1/3 OCTAVE ANALYSIS  
 BASE CONFIG. TRAVERSE ABOVE T/R C-L  
 RUN 112 TP 8

SYN CH  
 01 66  
 LEGEND  
 PARAMETER  
 V-ALPHA





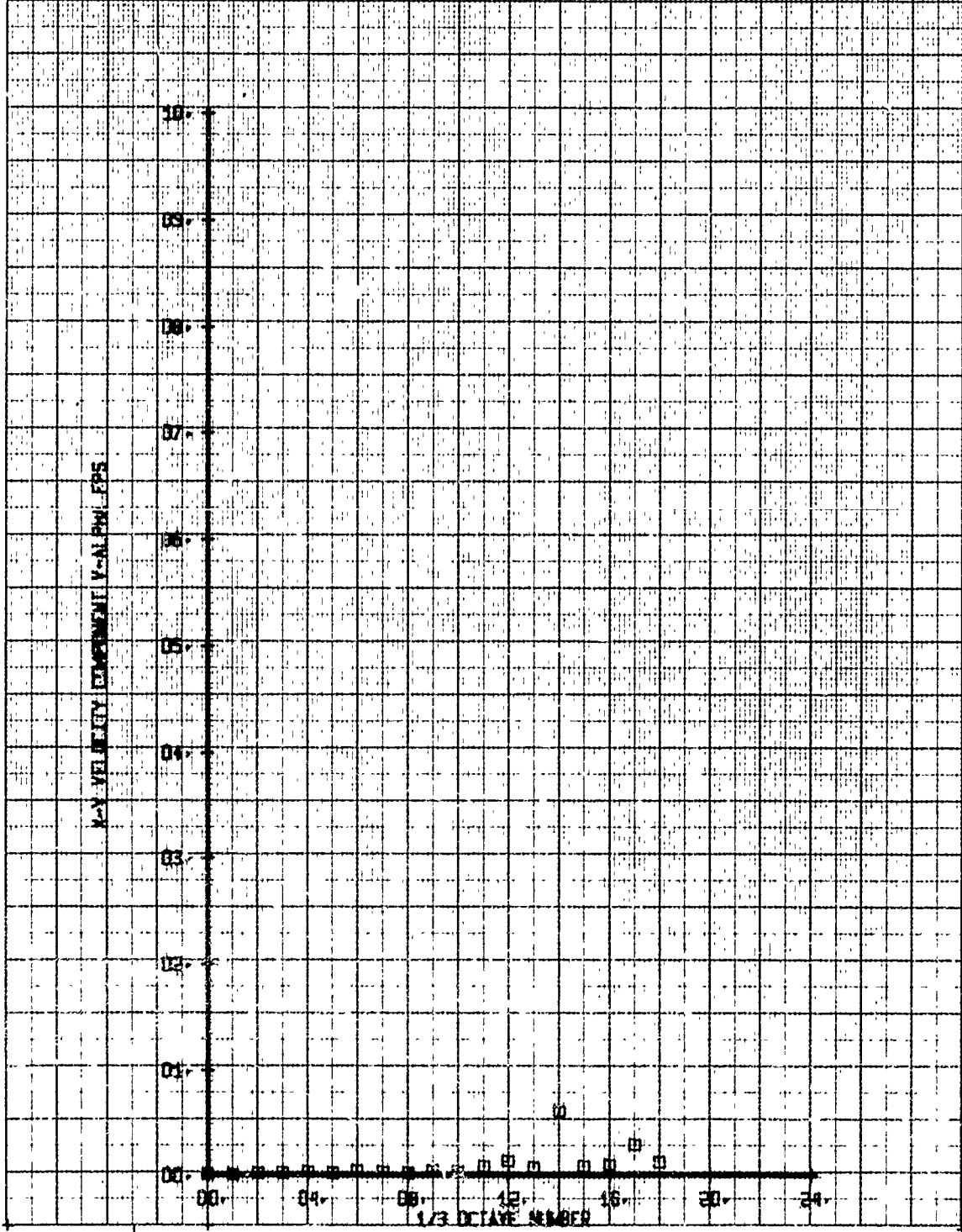
1975  
 BASE CONFIDENCE TRAVERSE ABOVE 1/4 C.L.  
 RUN 412 TP 12

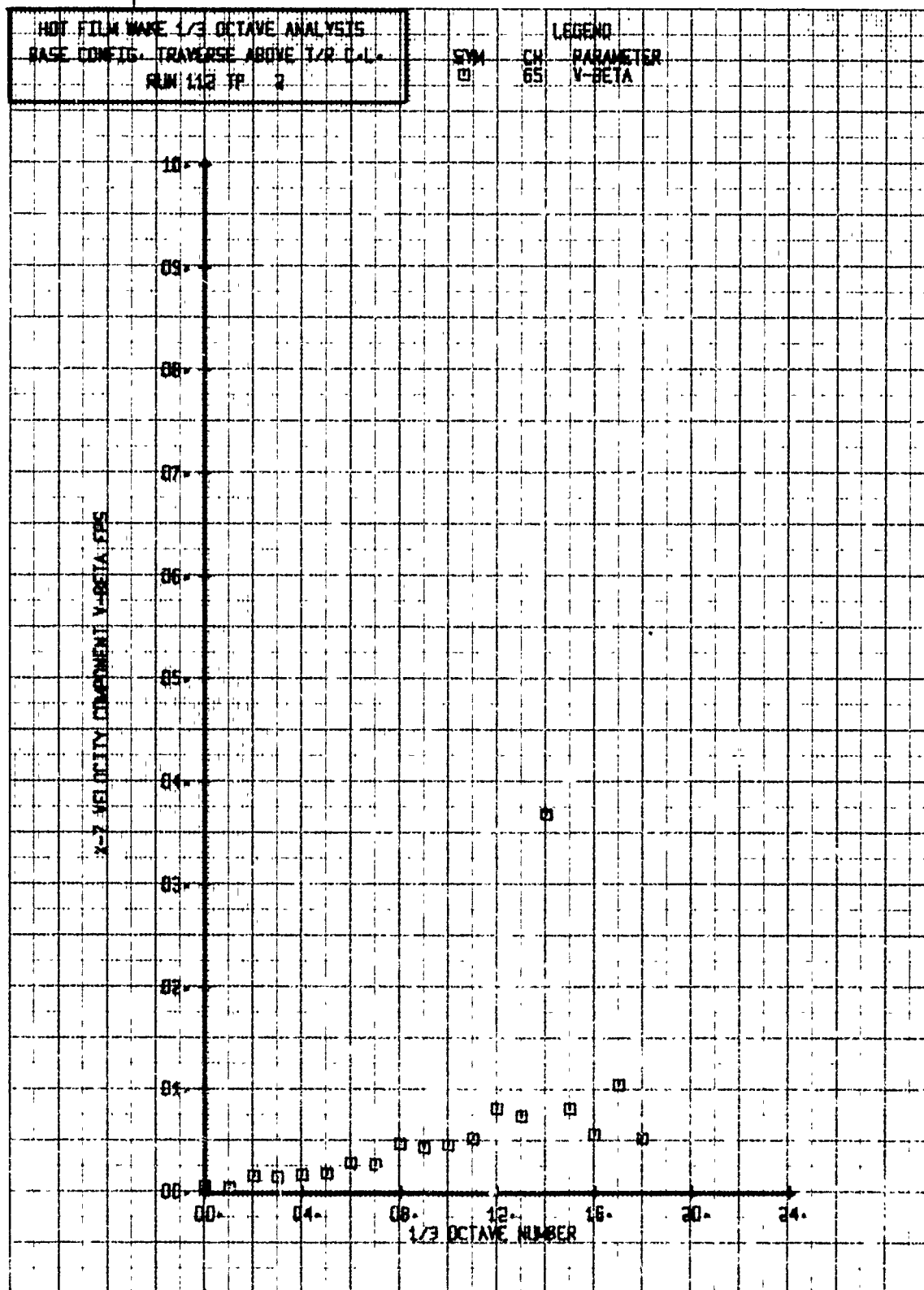
STM  
 0

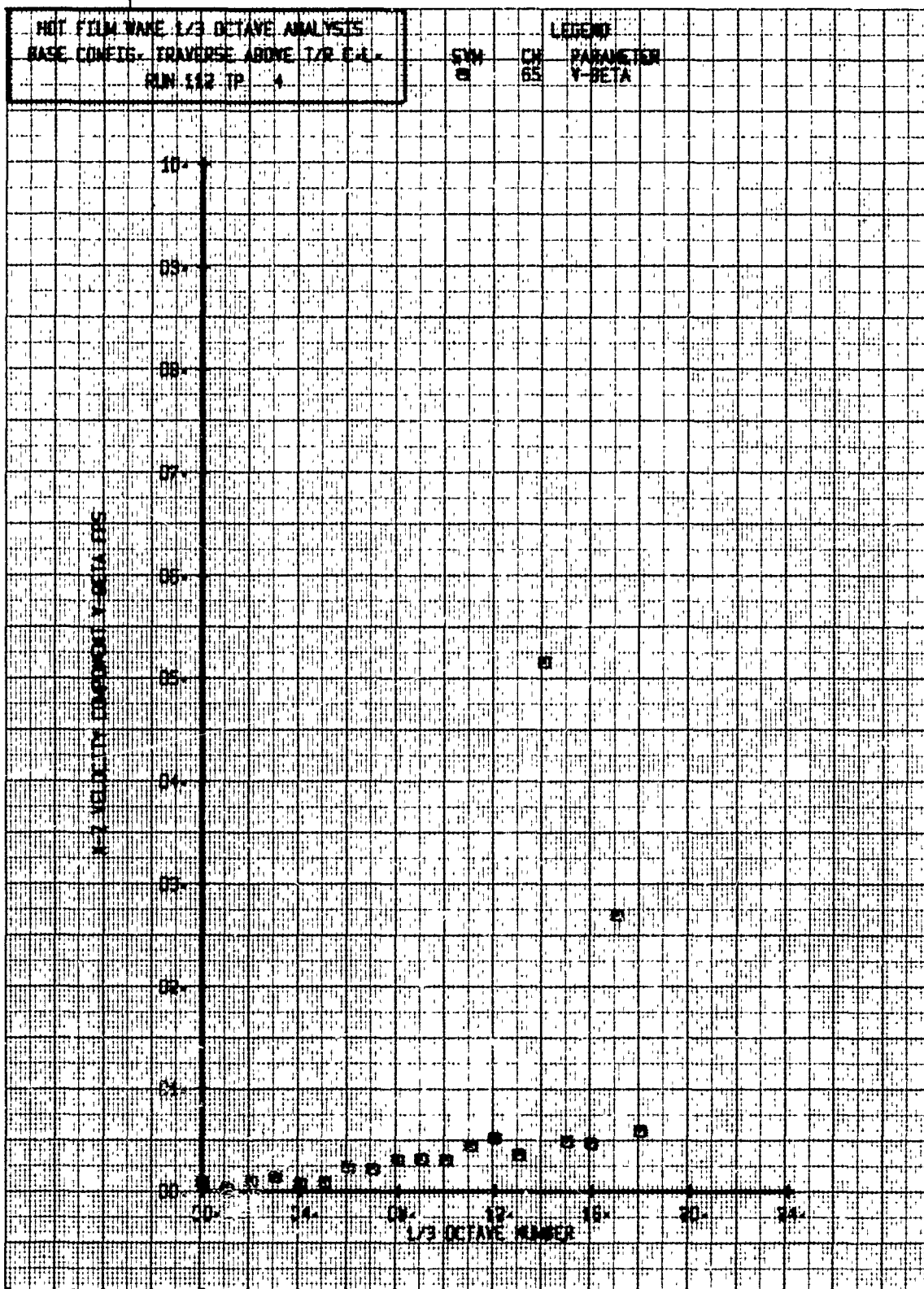
EH  
 86

LEGEND  
 PARAMETER  
 V-ALPHA

V-ALPHA

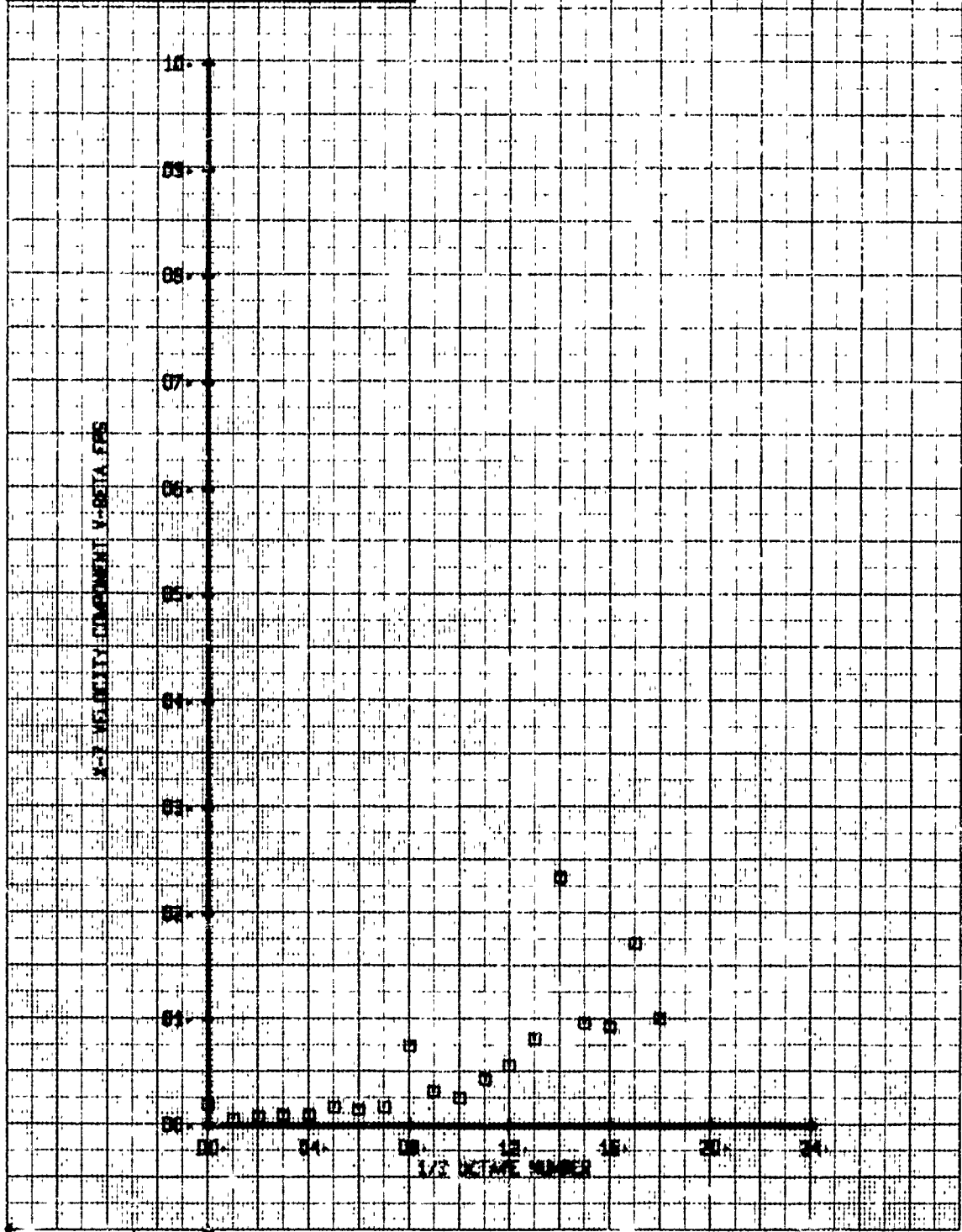




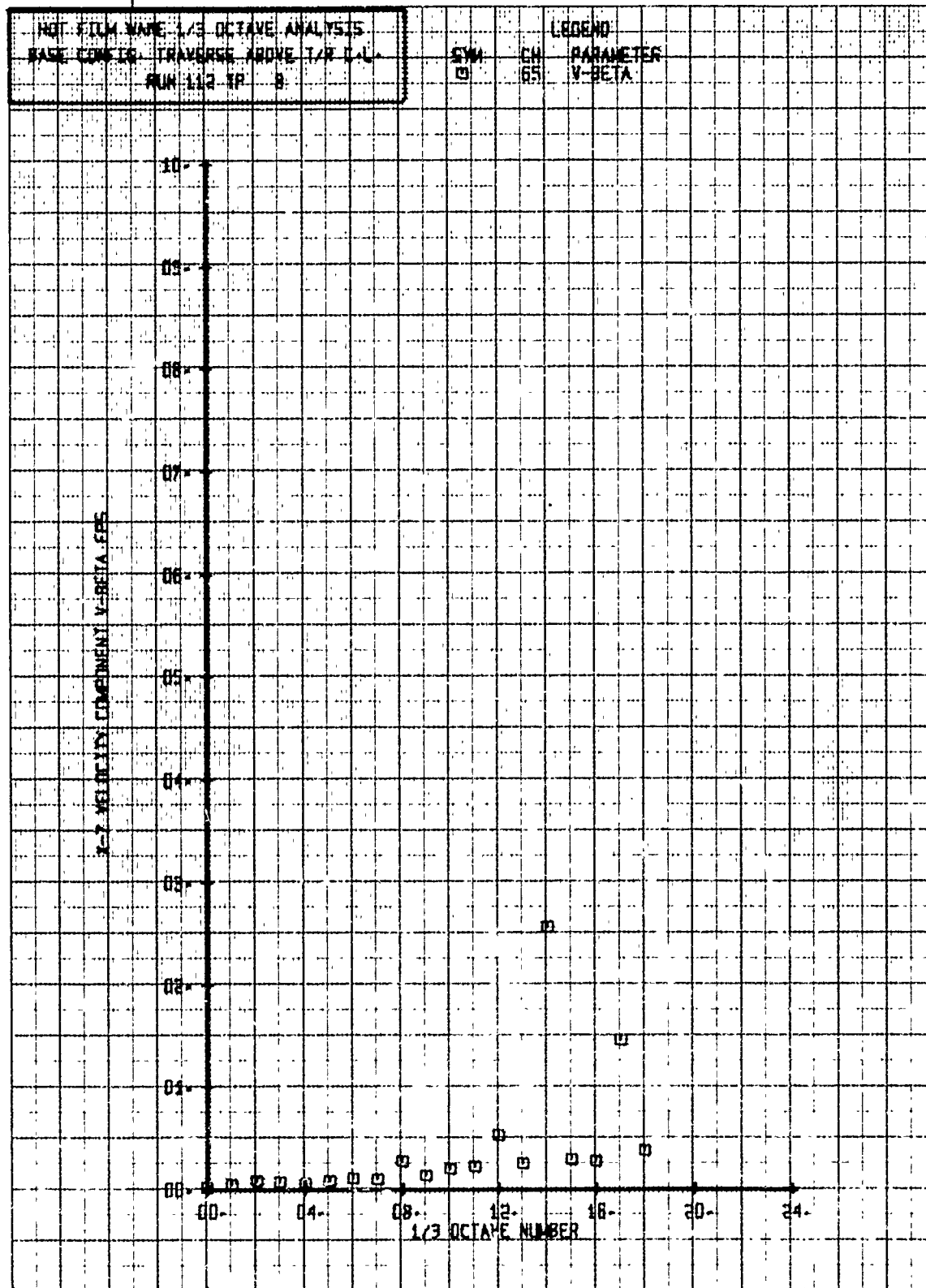


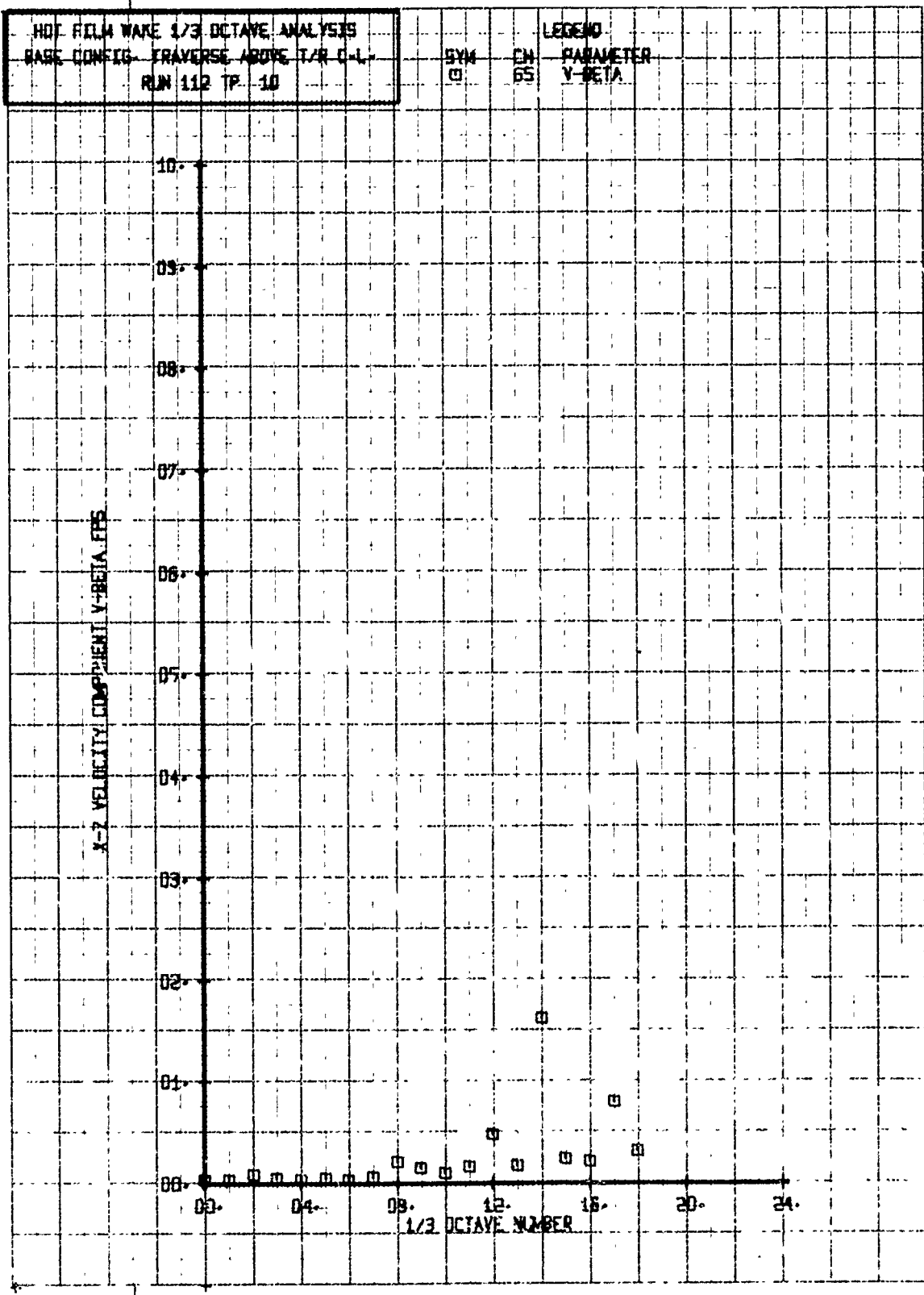
HOT FILM WAKE 1/3 OCTAVE ANALYSIS  
 BASE CONFIG. TRAVERSE ABOVE T/R C-L  
 RUN 112 TP 6

SYM CH PARAMETER  
 0 65 V-BETA





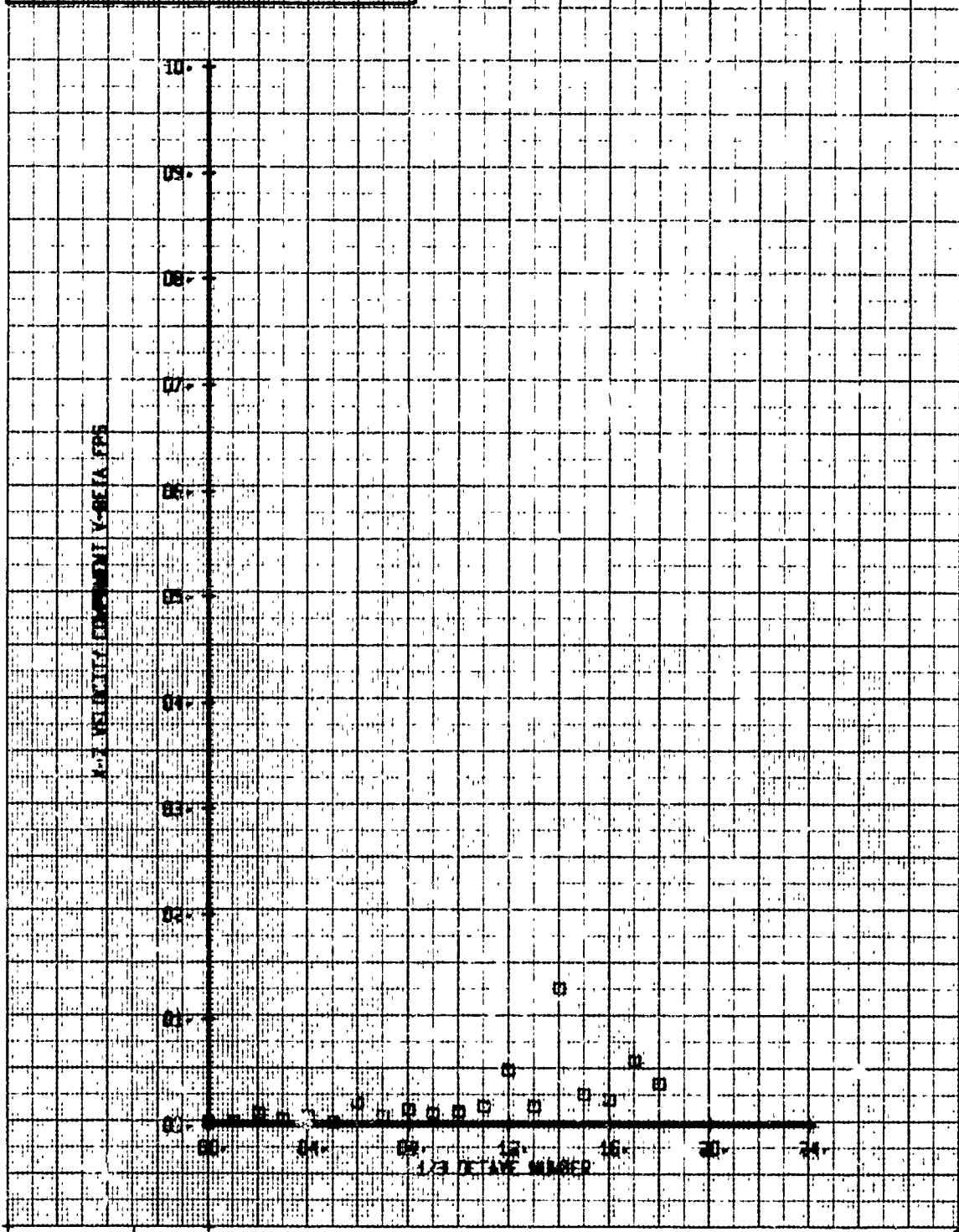


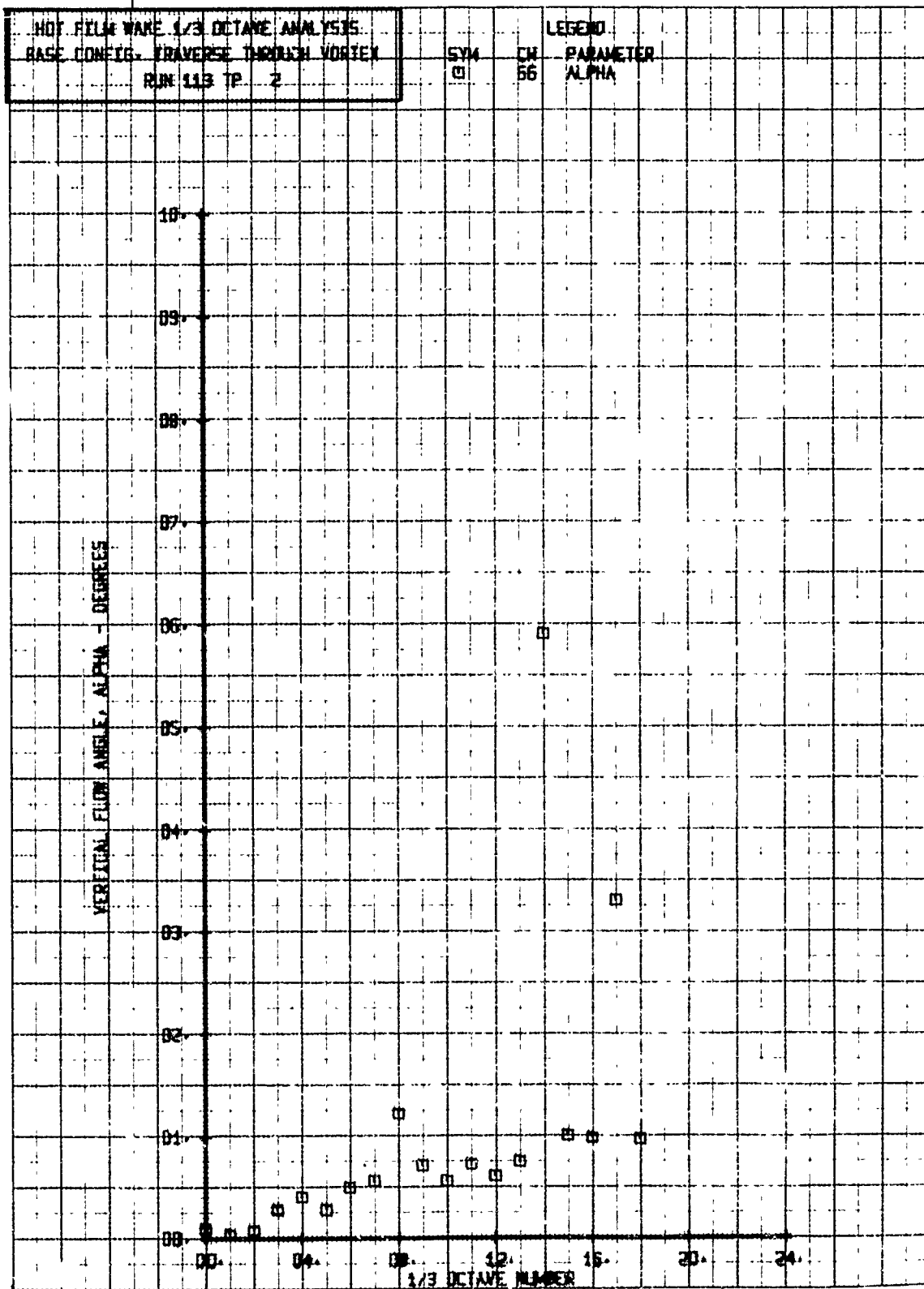


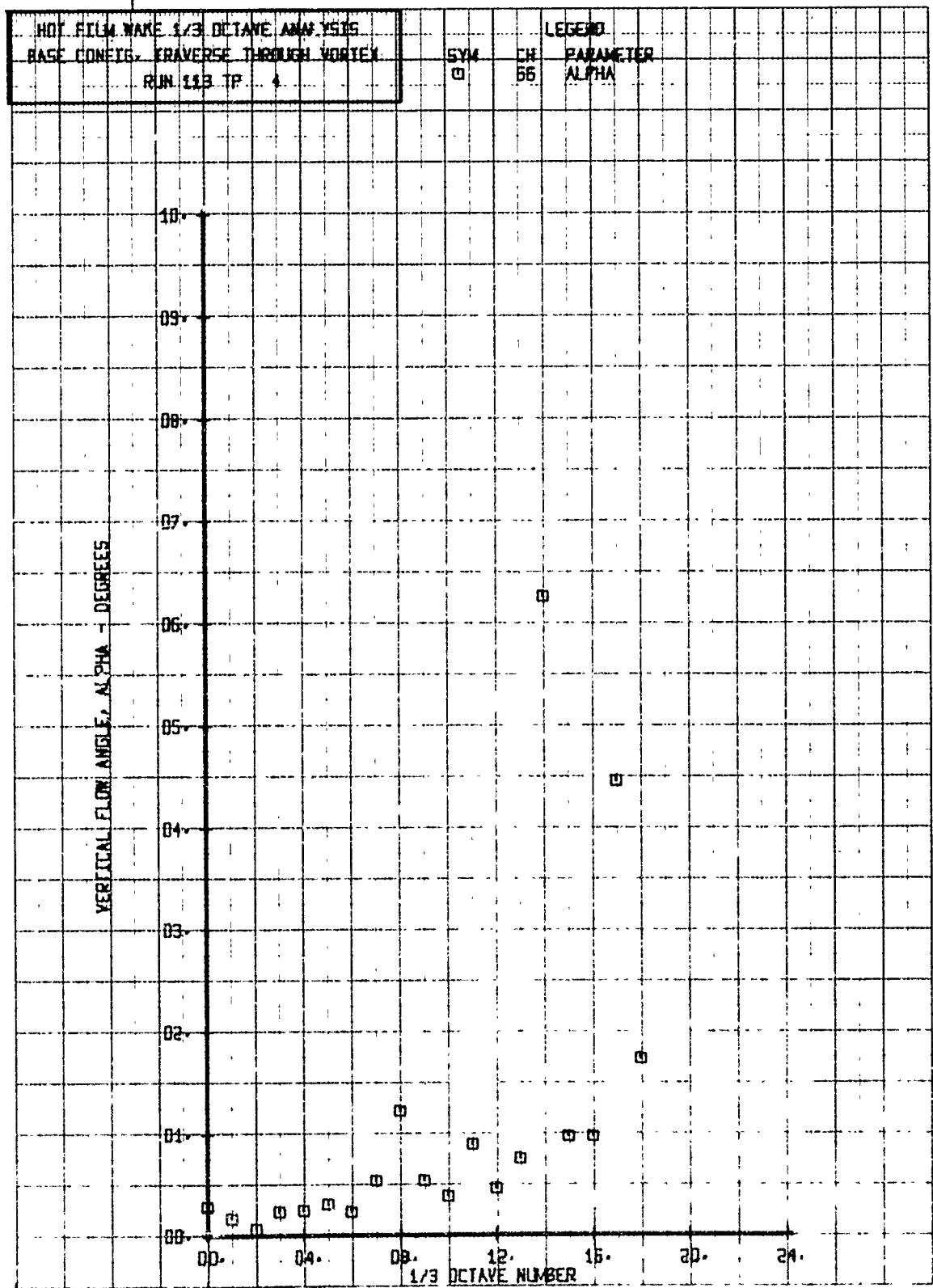
HOF FILM WAKE 1/3 OCTAVE ANALYSIS  
 BASE CONFIG TRAVERSE ABOVE 1/R C-L  
 RUN 112 TP 12

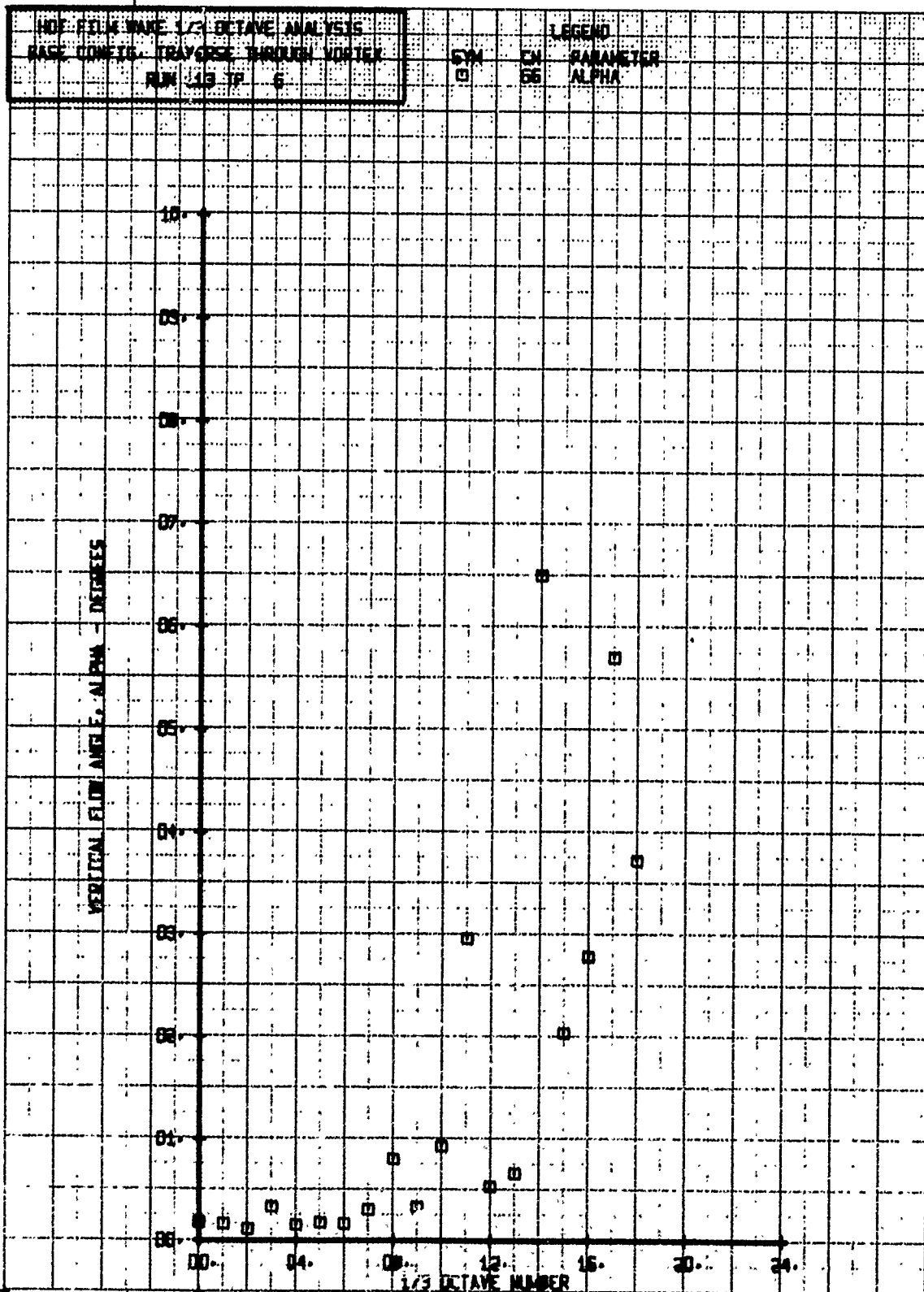
SYM  
 □

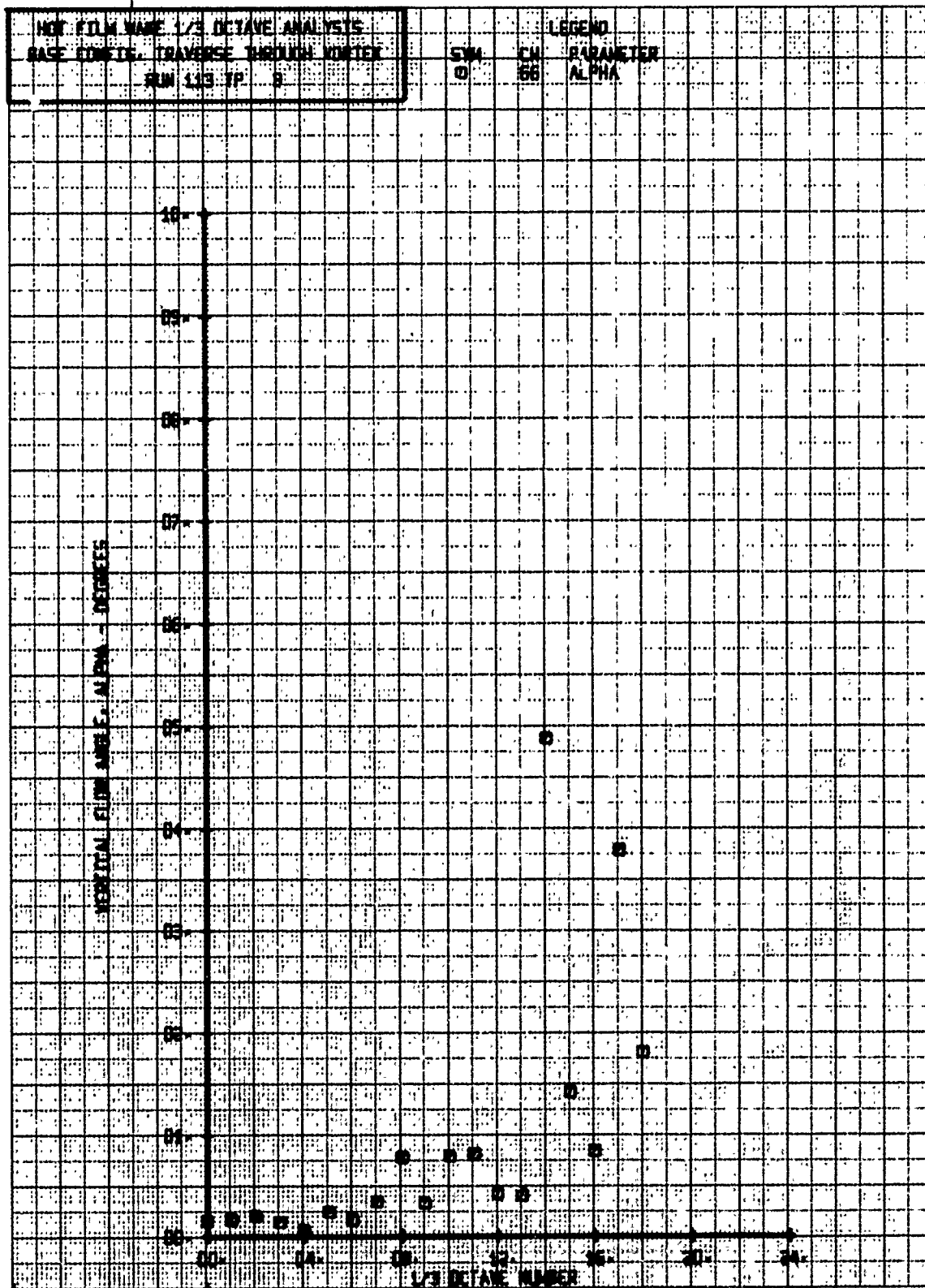
LEGEND  
 CH 65  
 PARAMETER  
 V-BETA

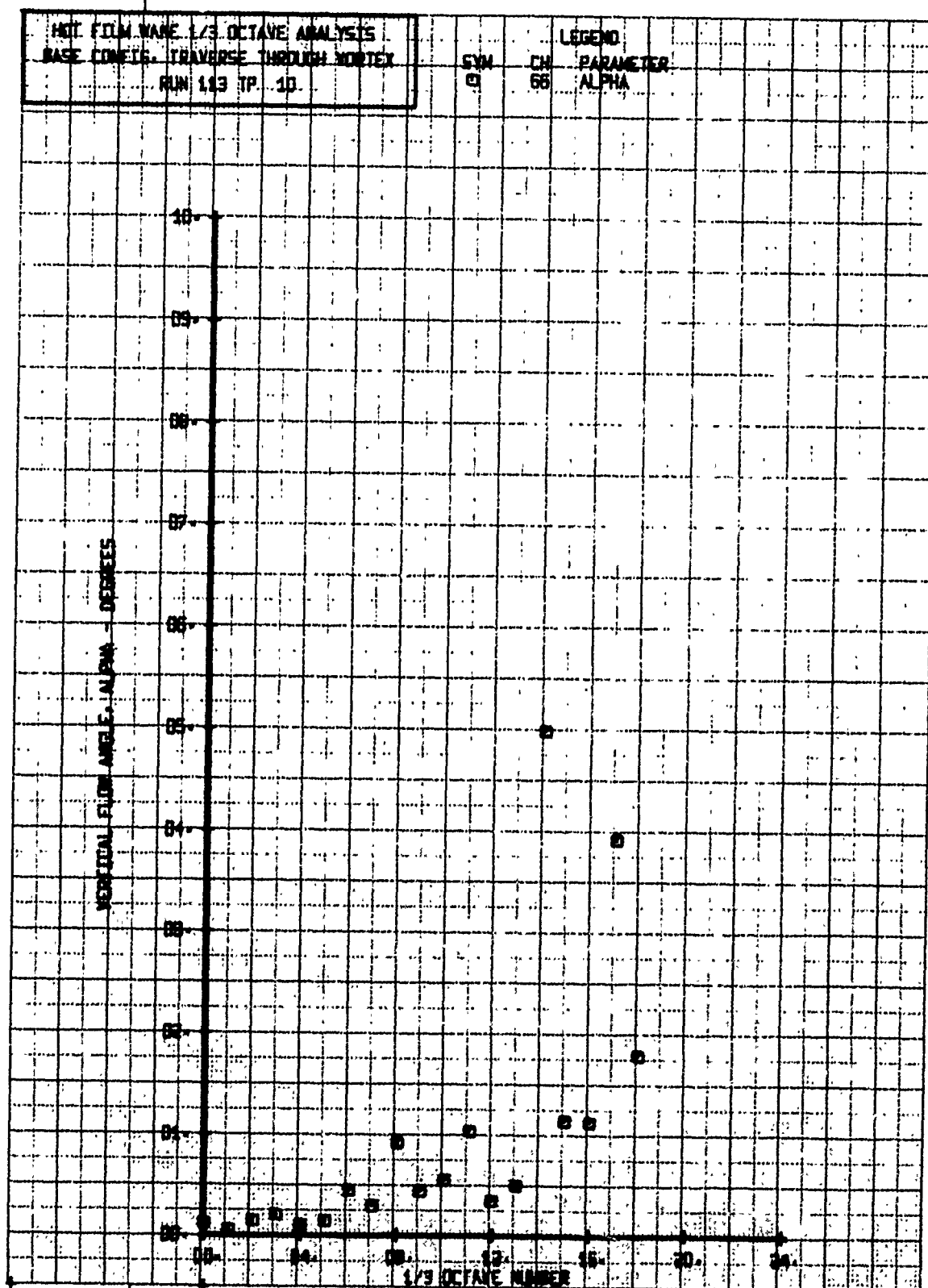




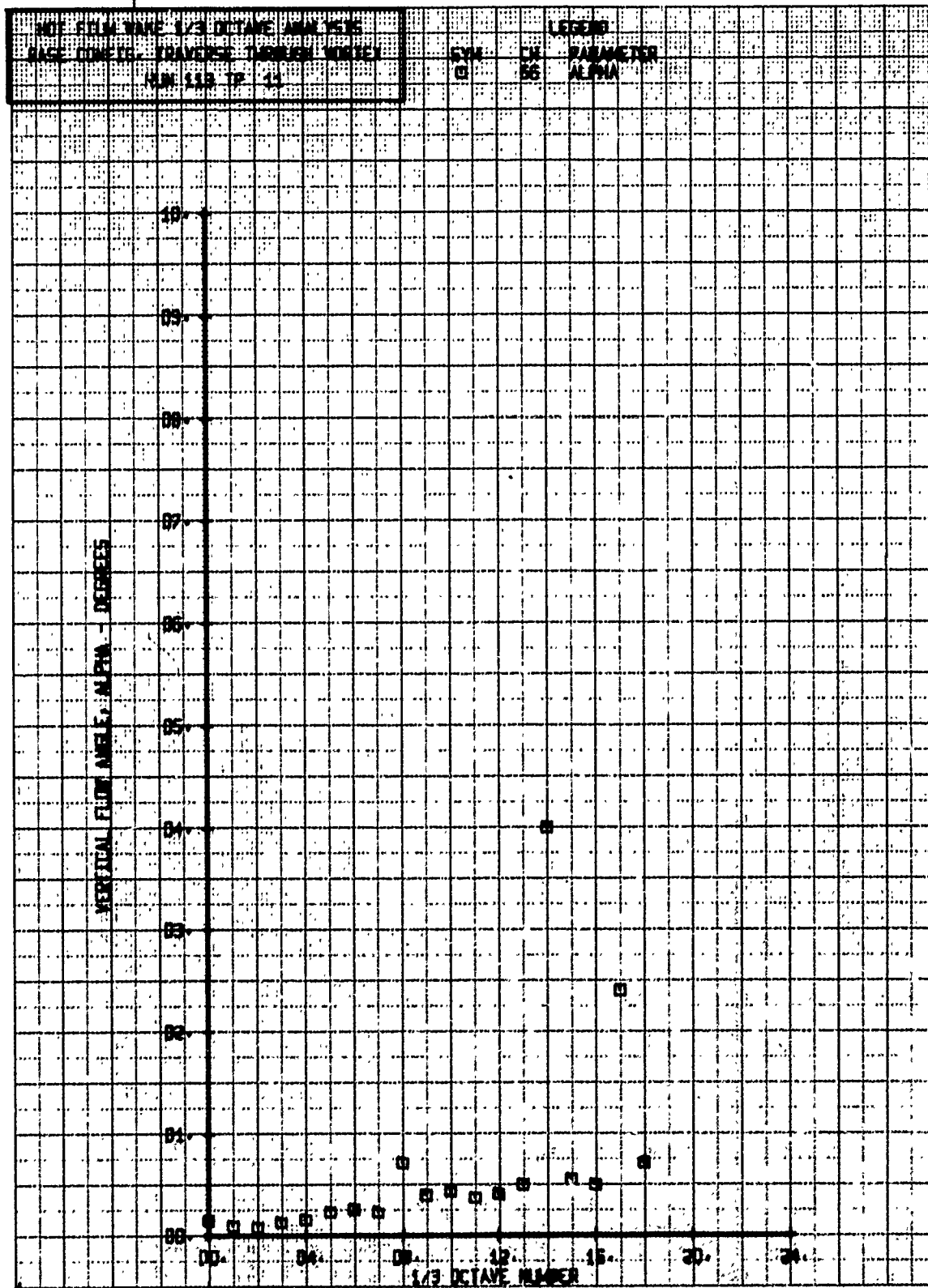


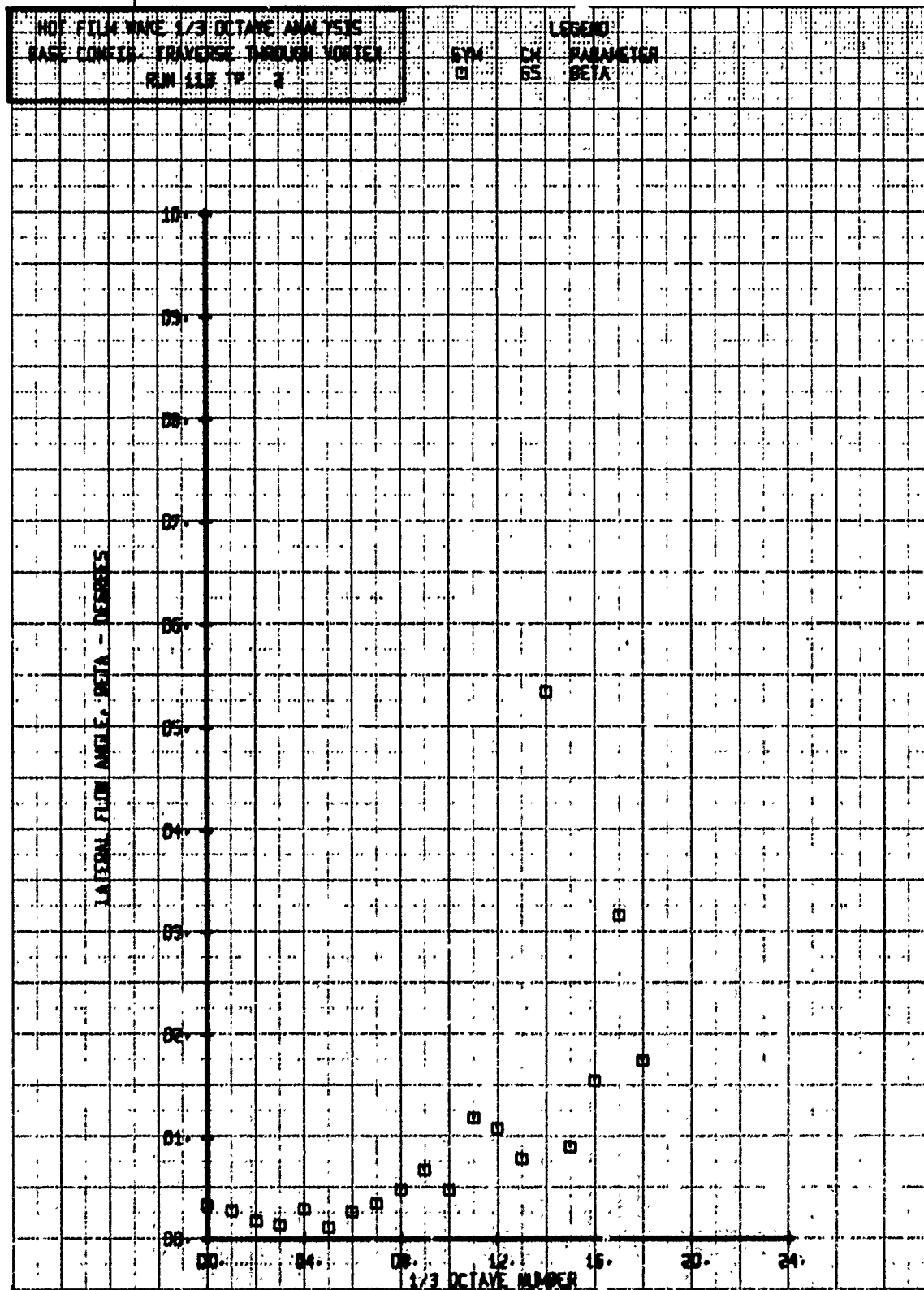


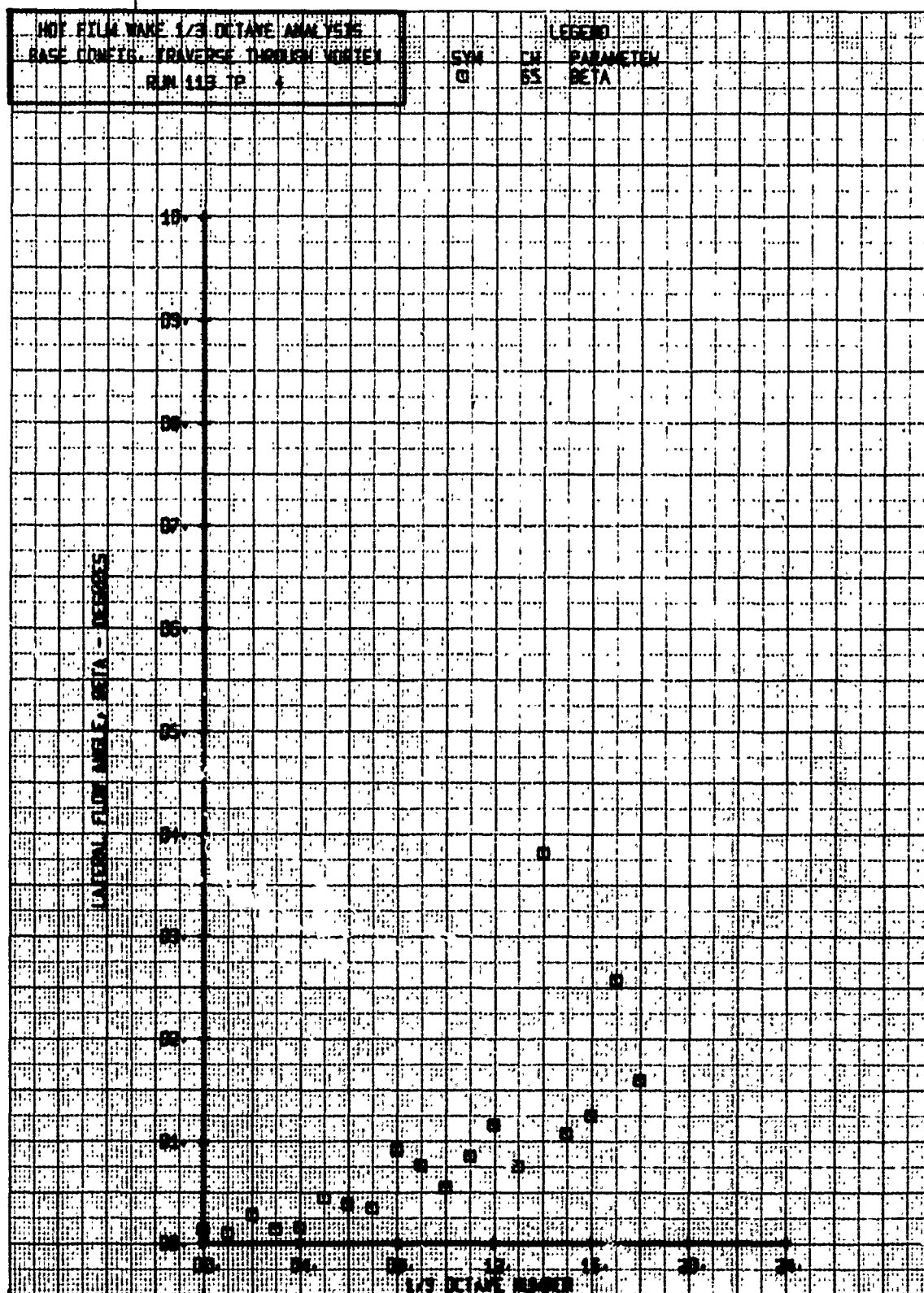




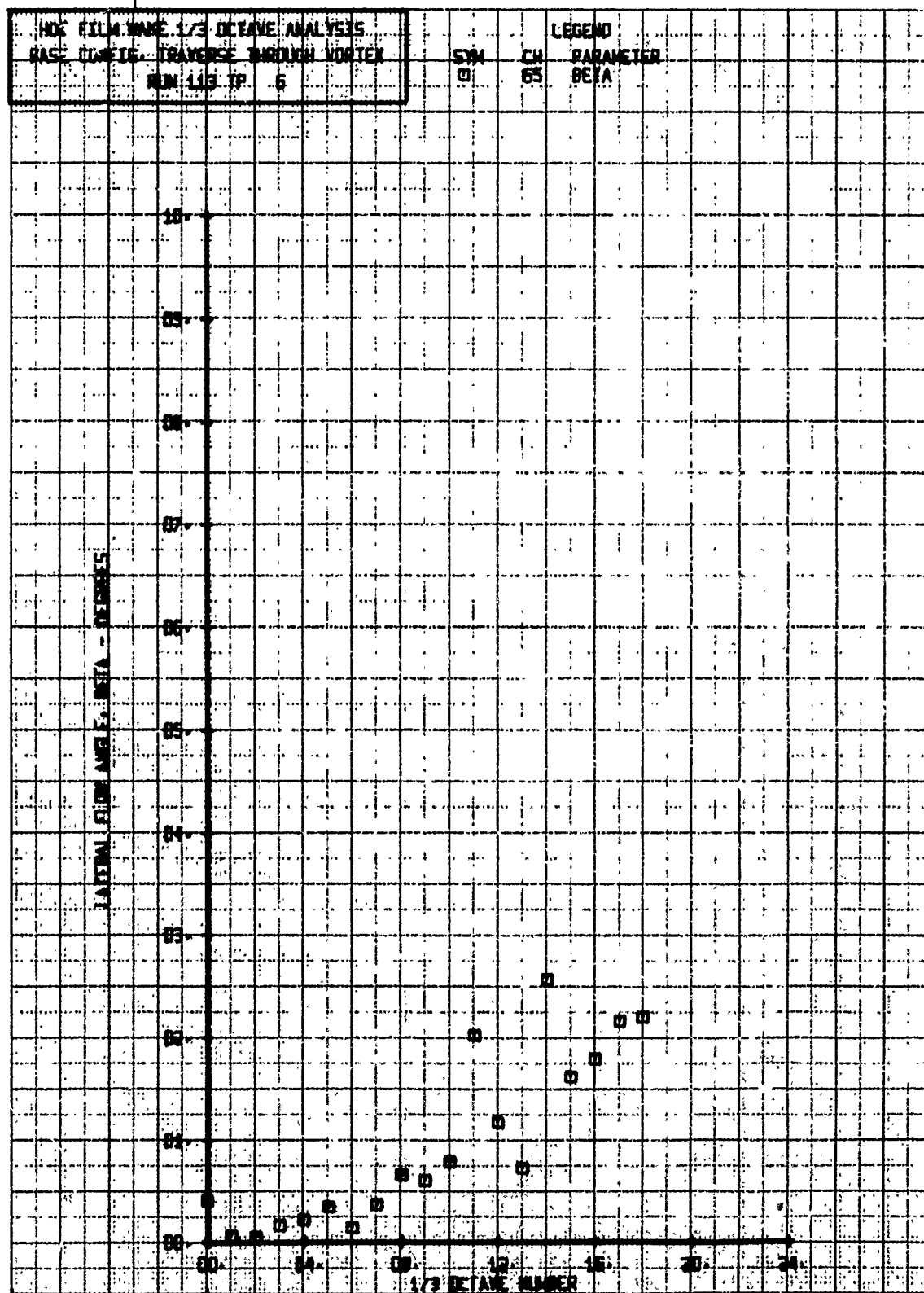


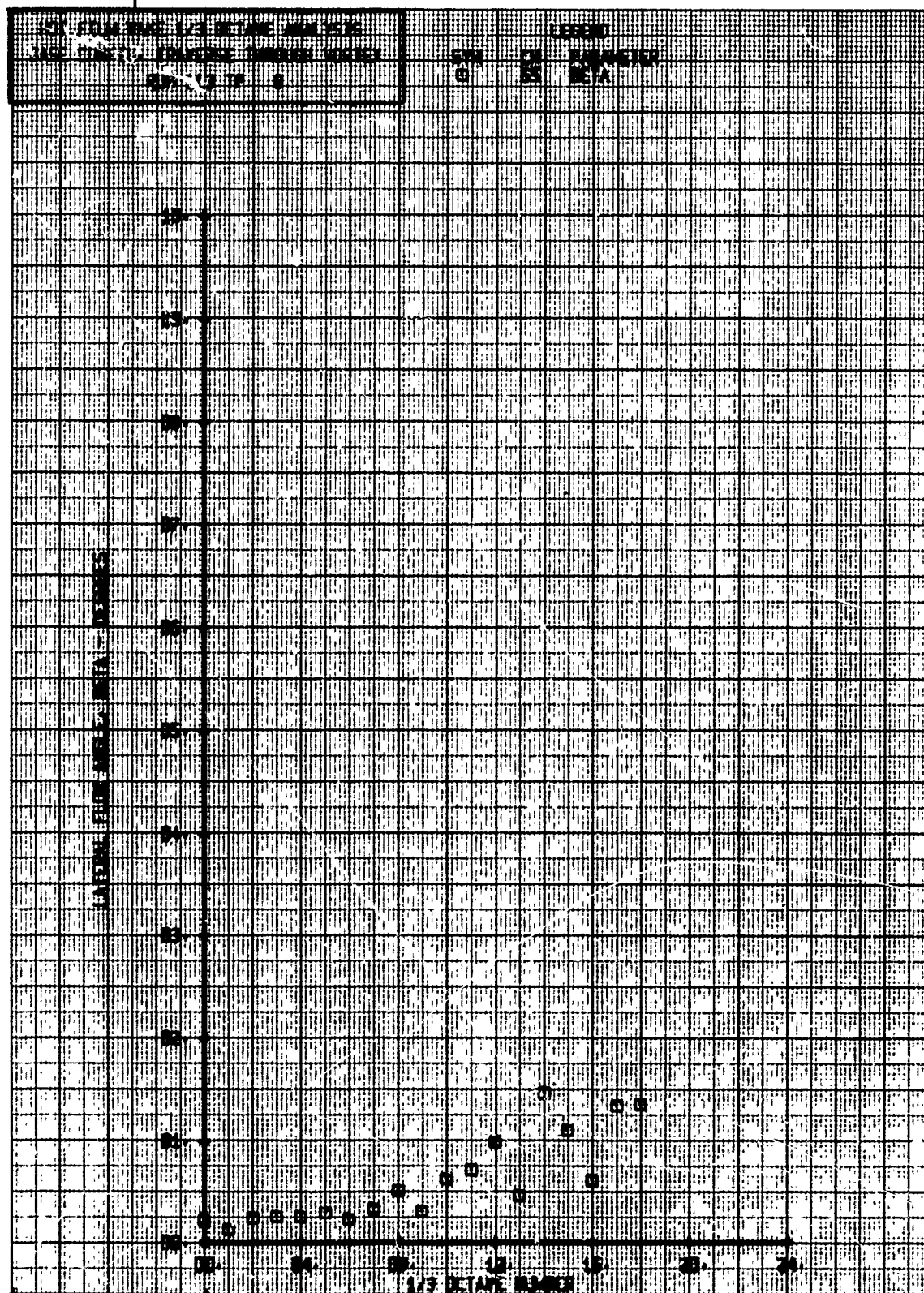






| LEGEND |    |           |
|--------|----|-----------|
| SYM    | CH | PARAMETER |
| 0      | 65 | DETA      |





100-443886-100  
 100-443886-100  
 100-443886-100

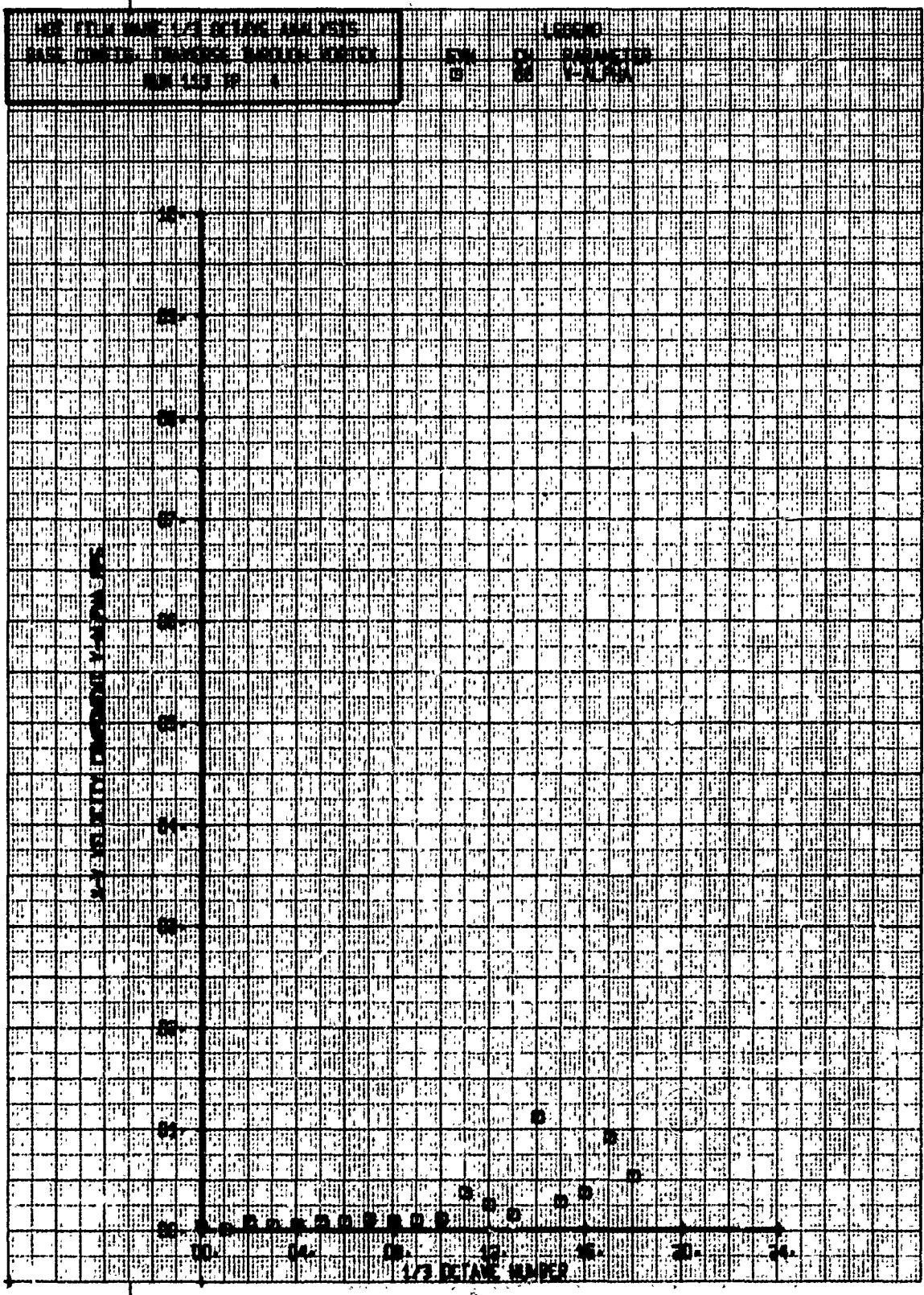


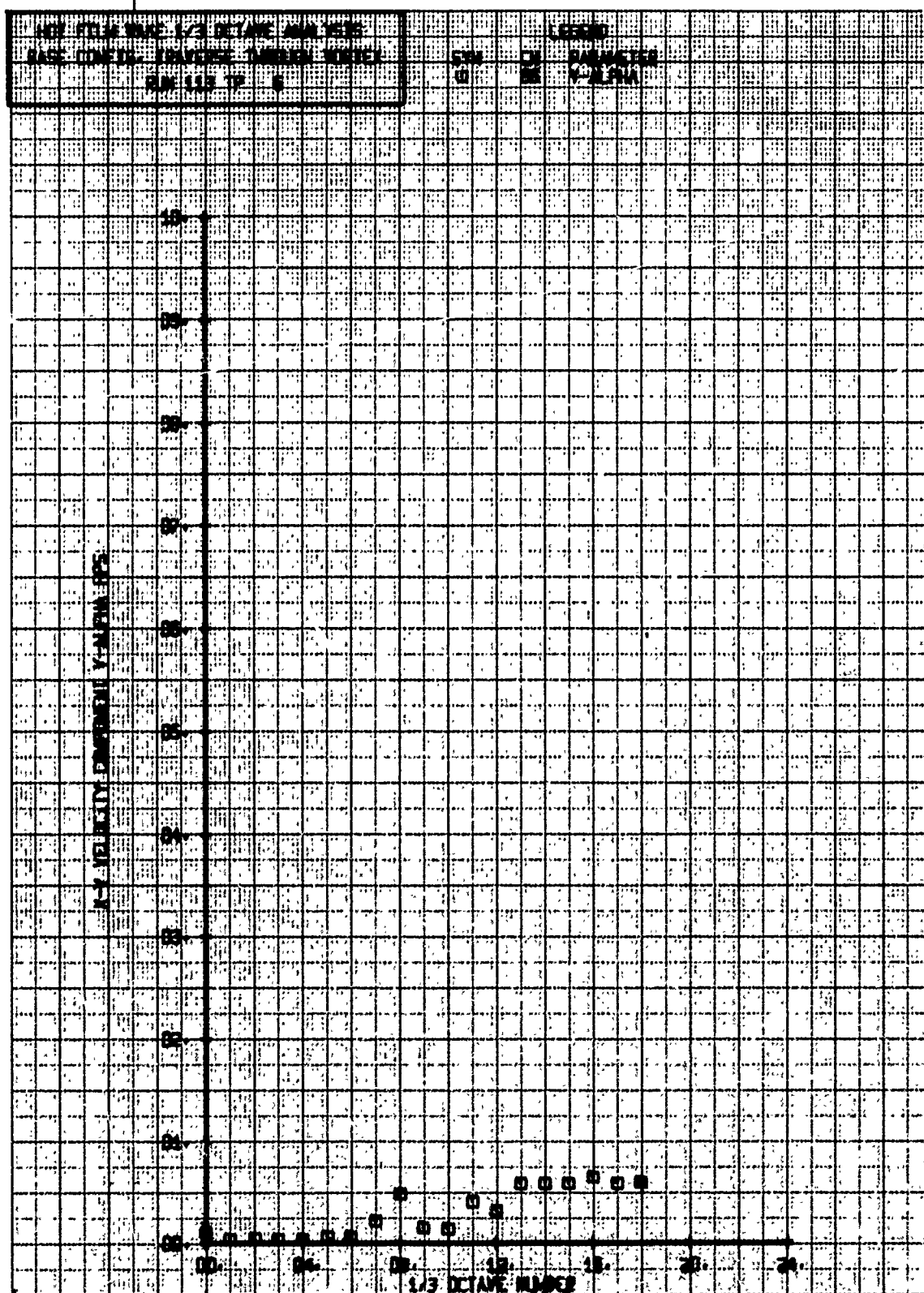


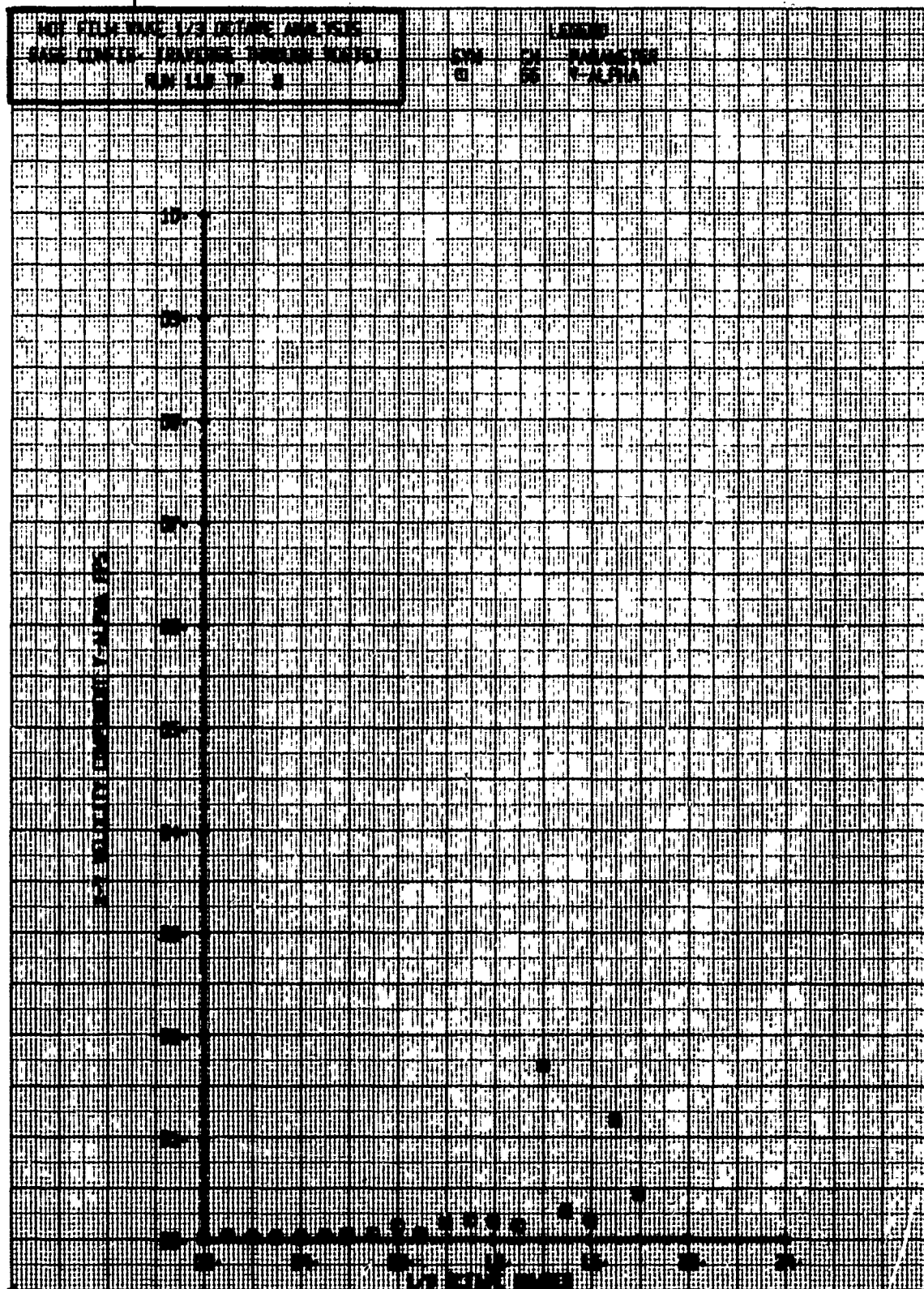






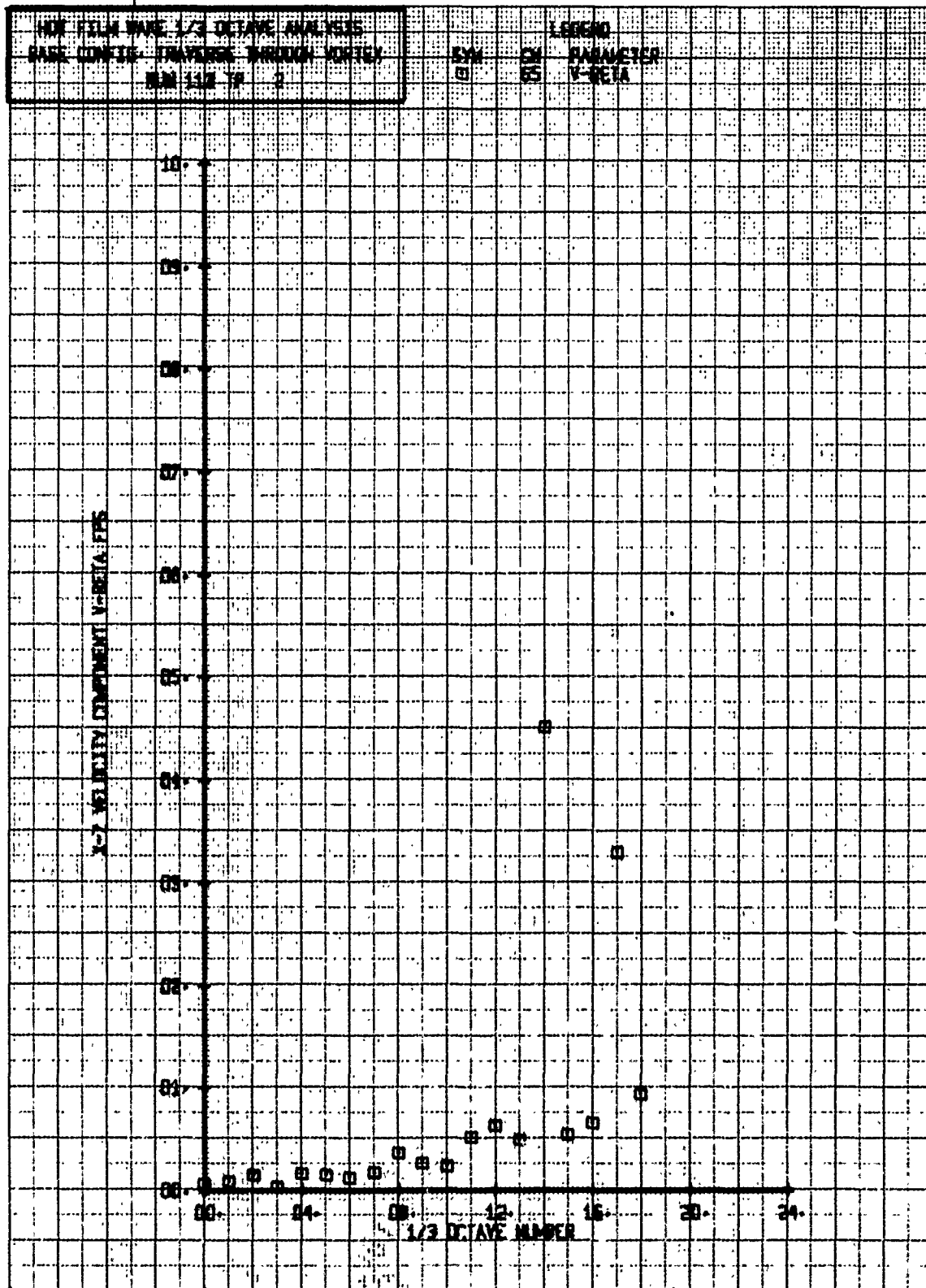










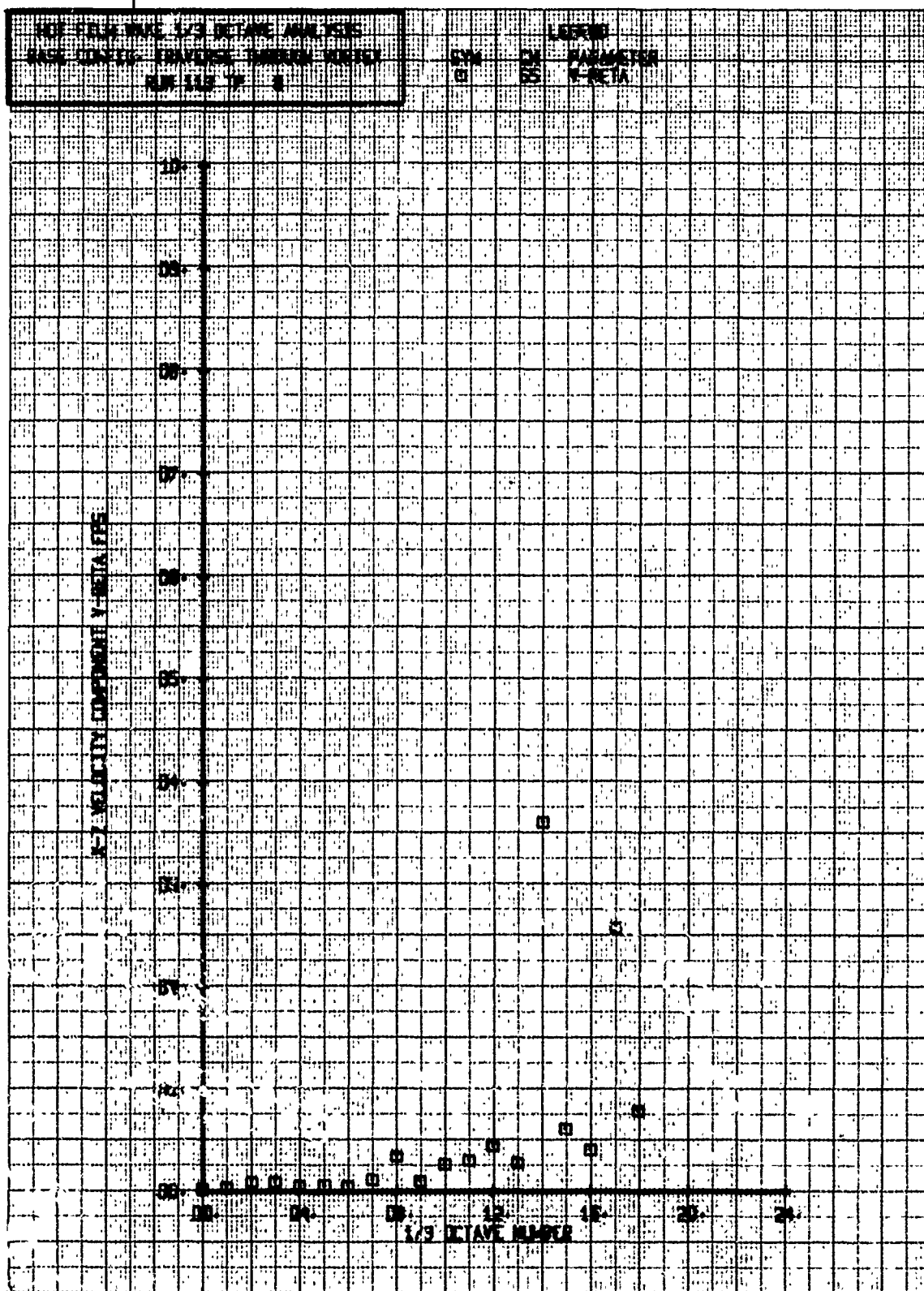


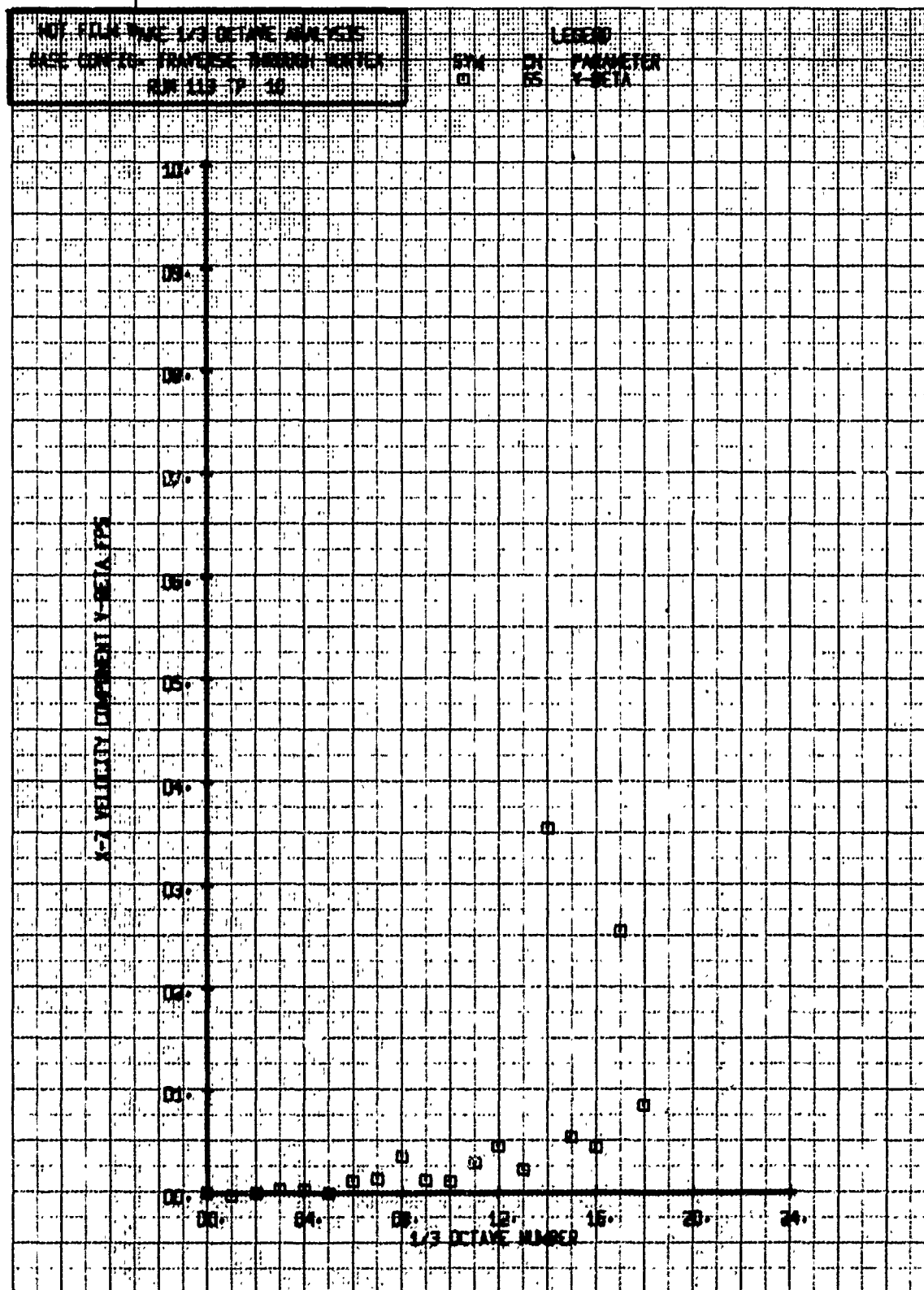


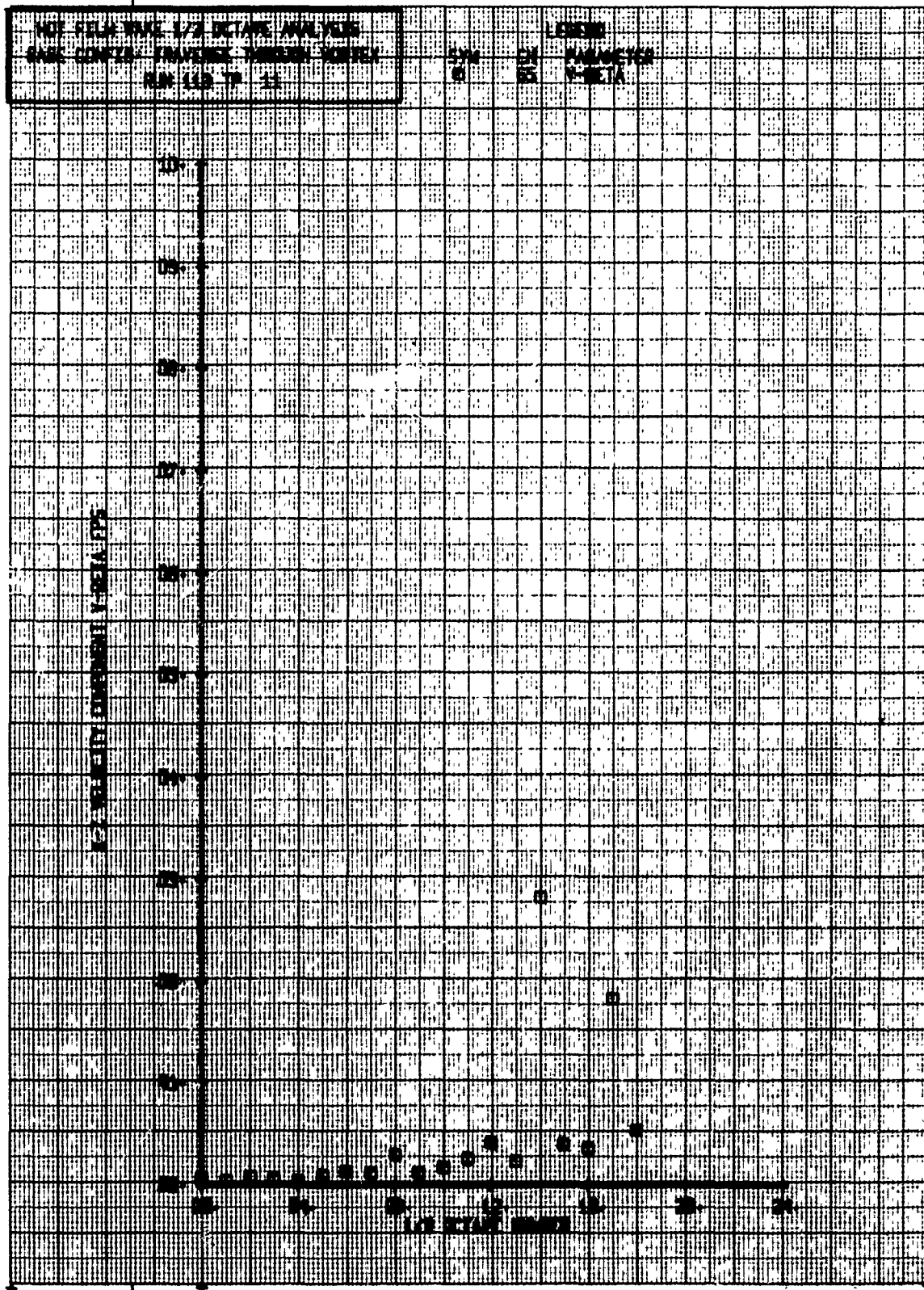


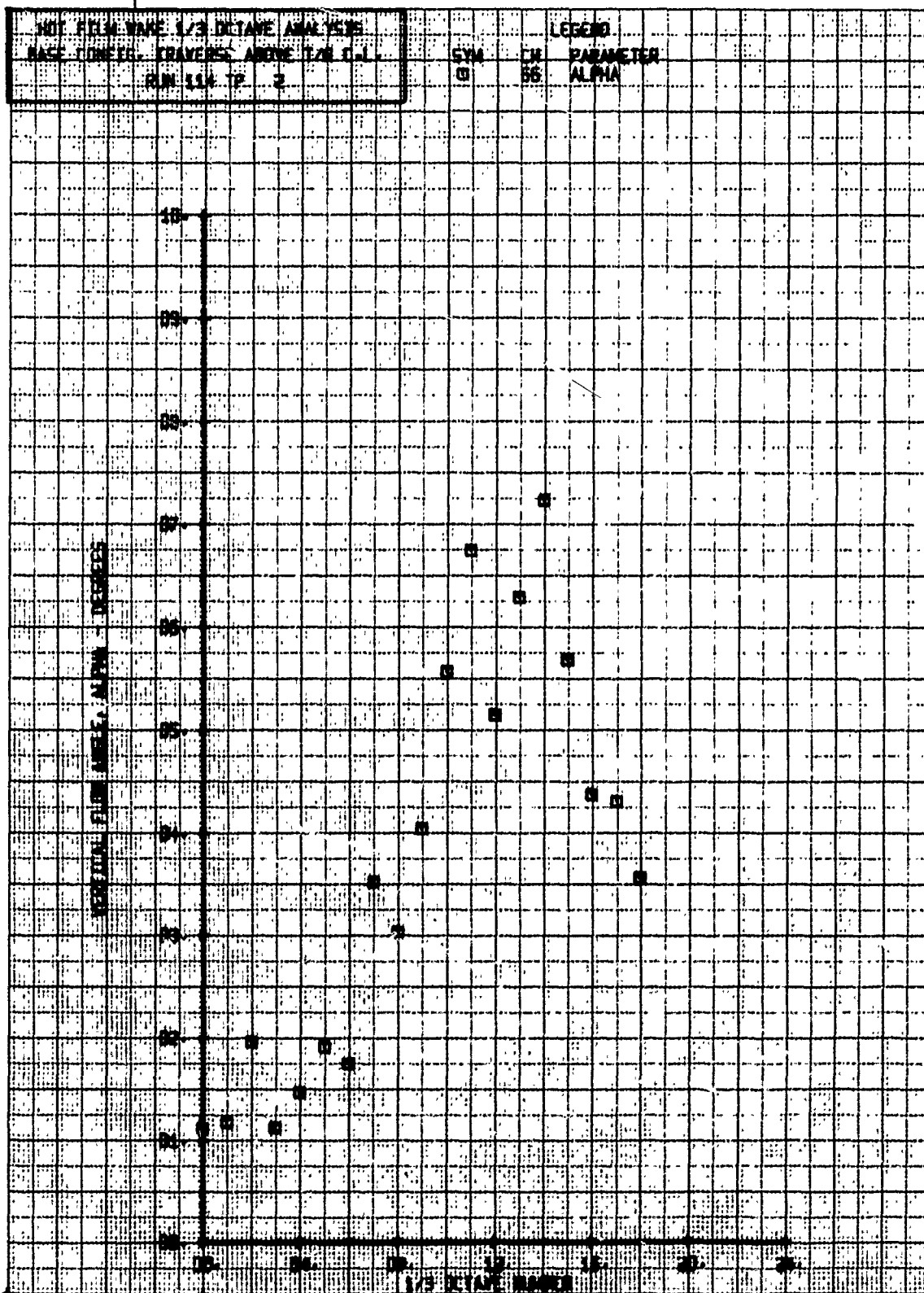


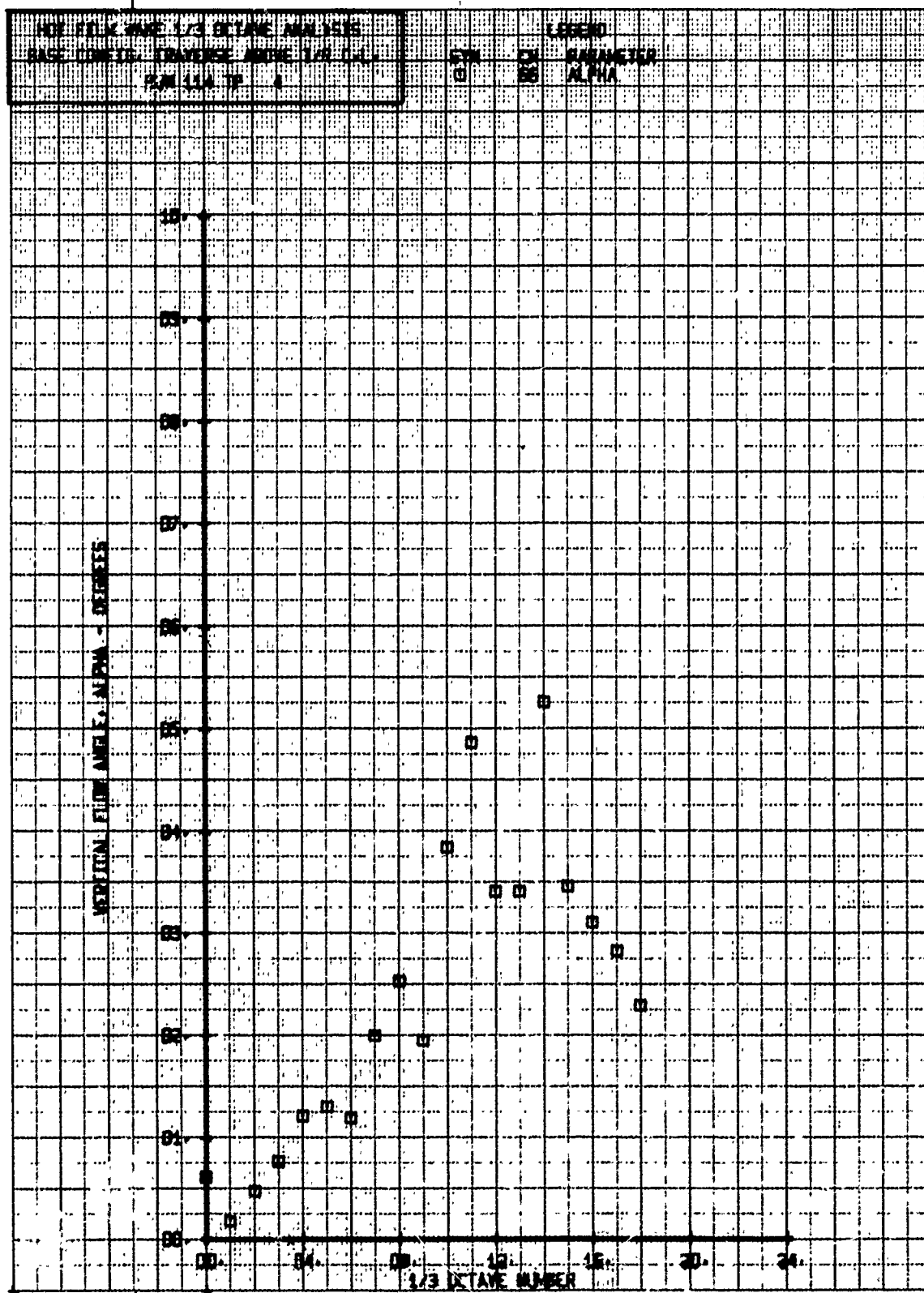


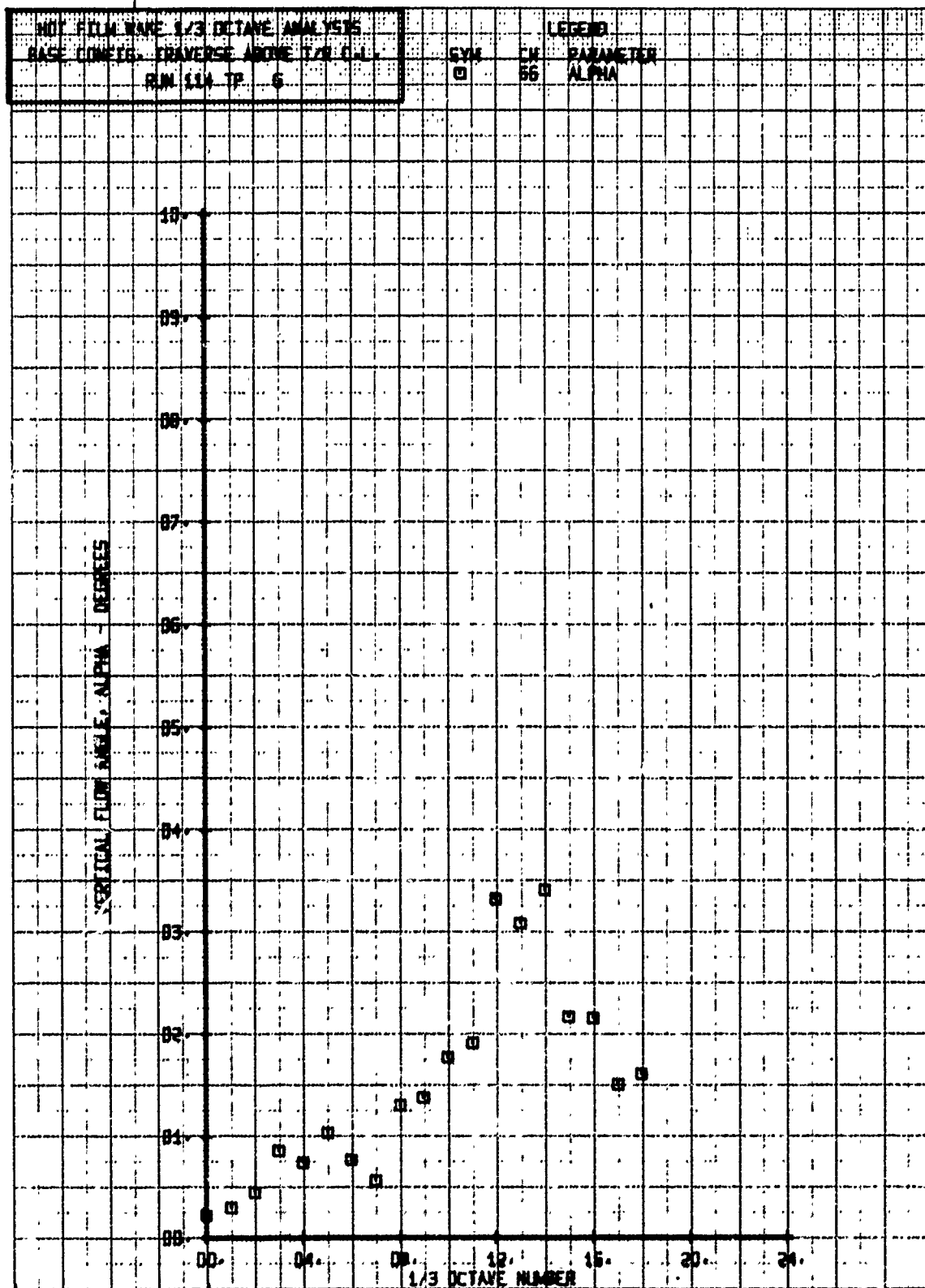


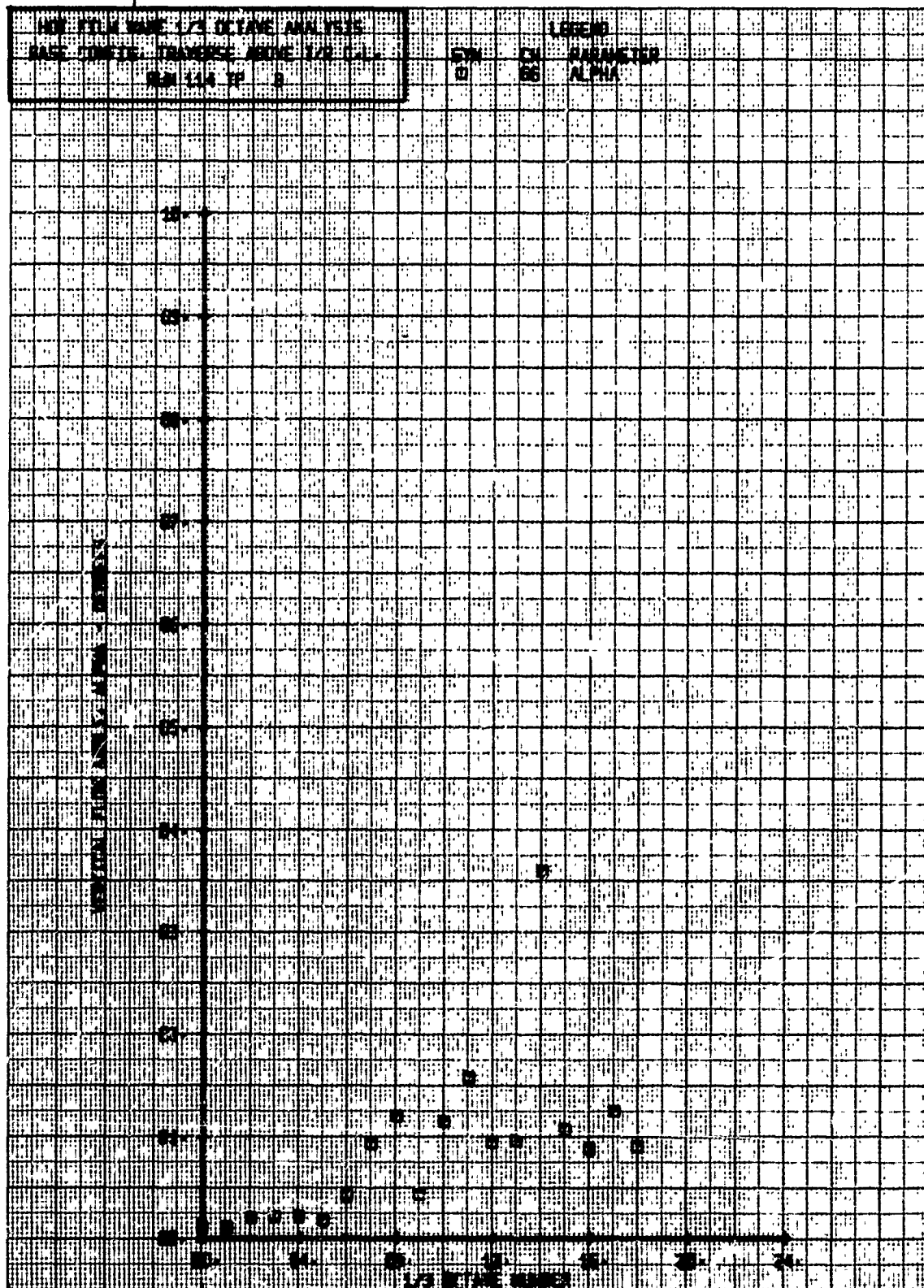




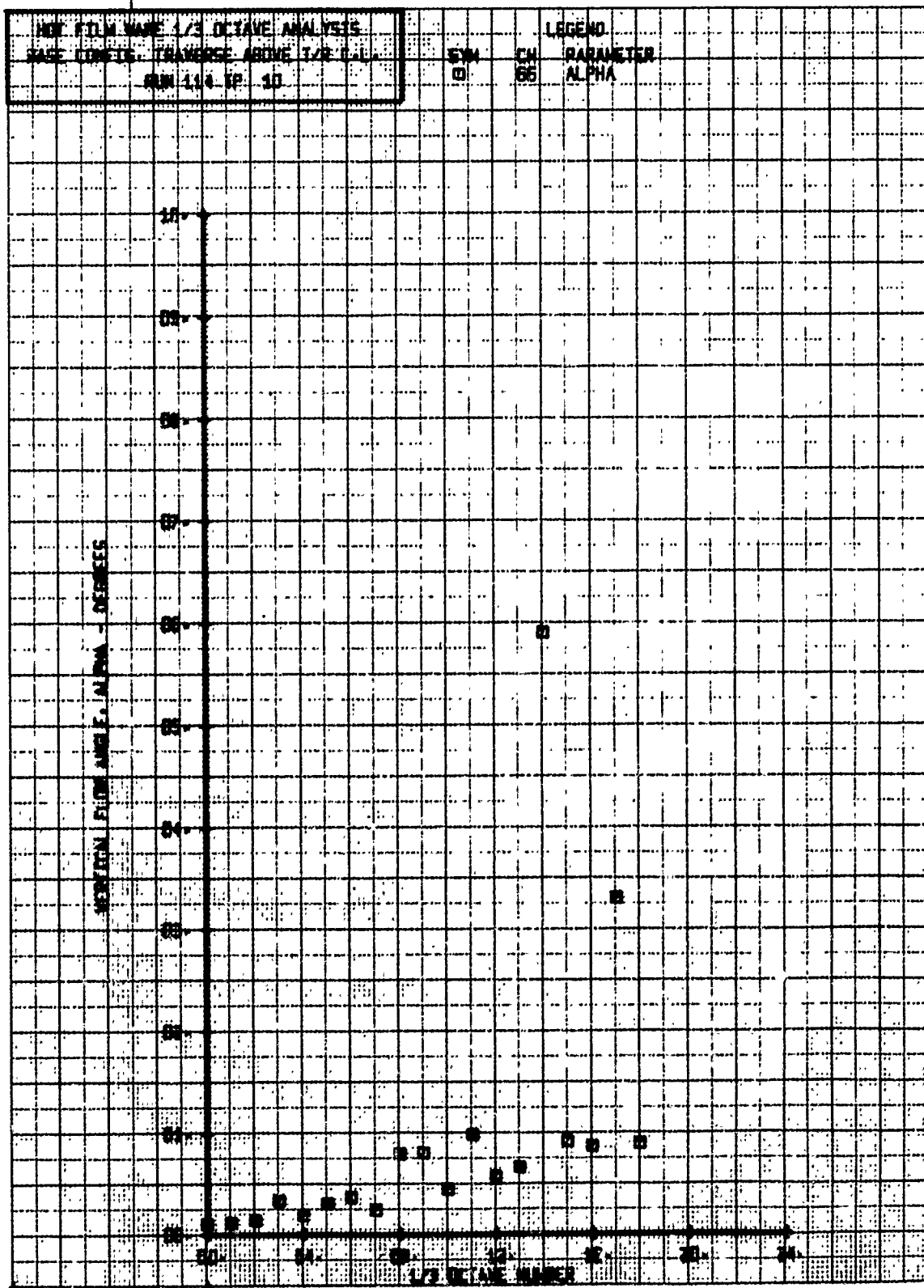




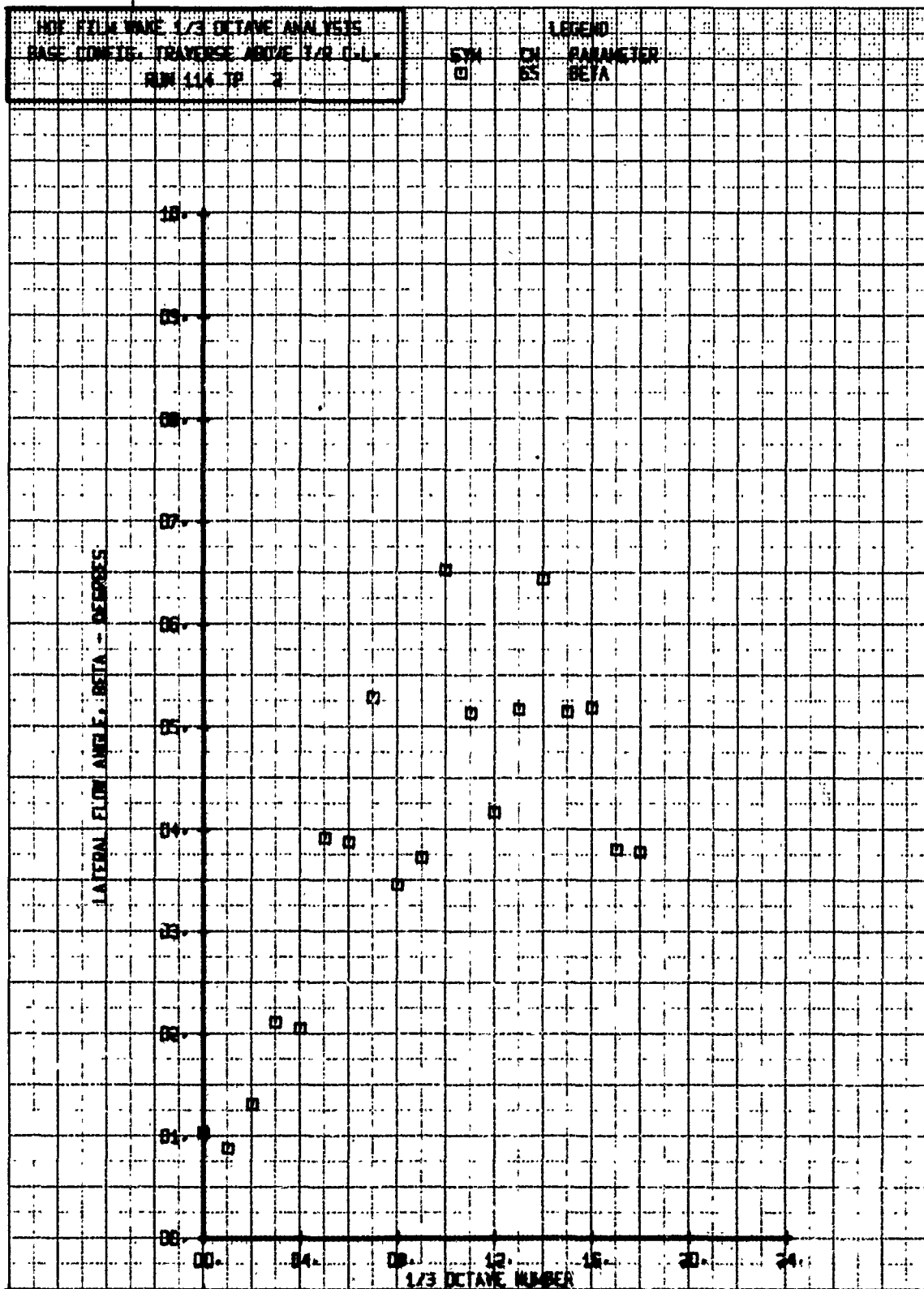


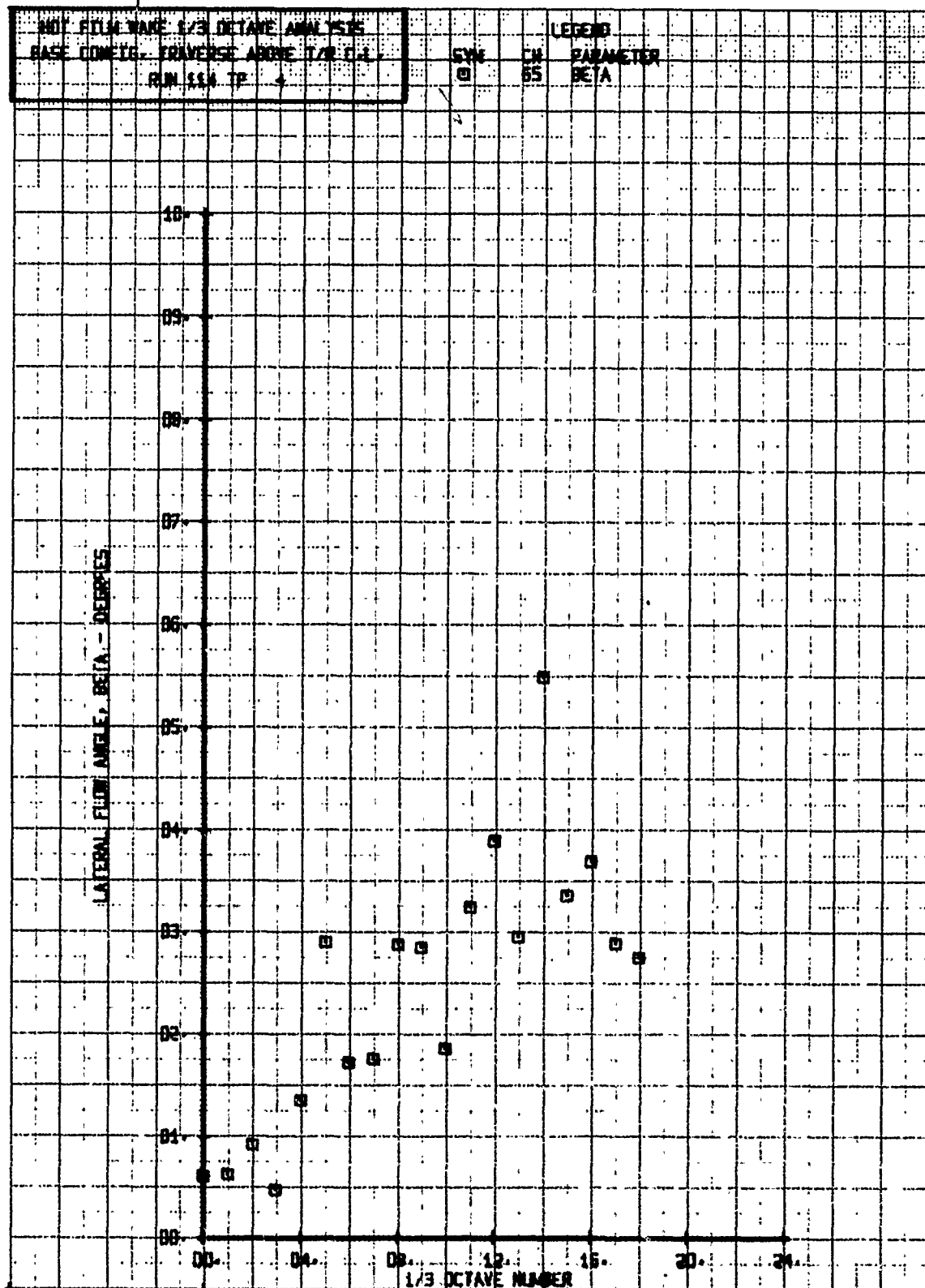


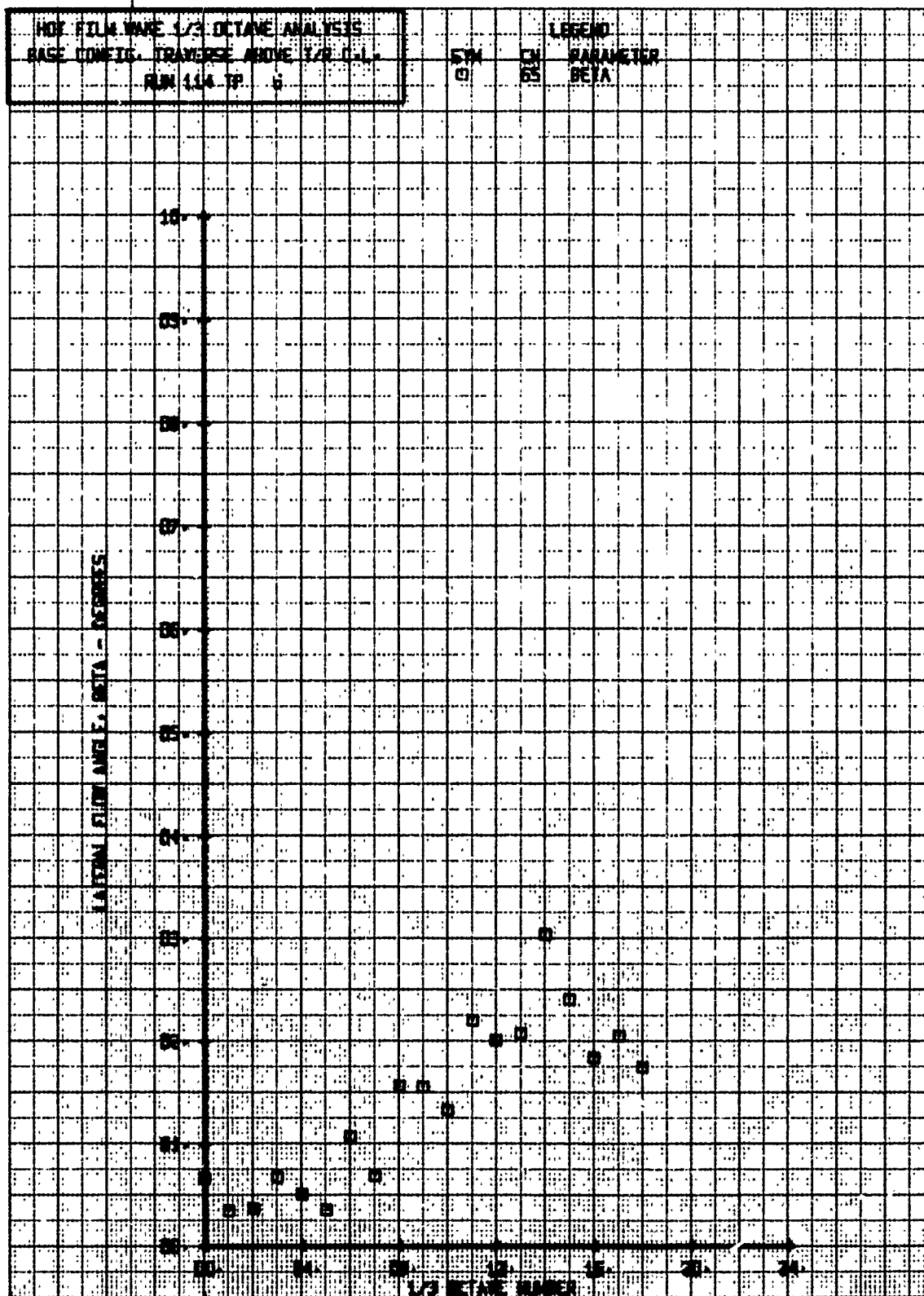


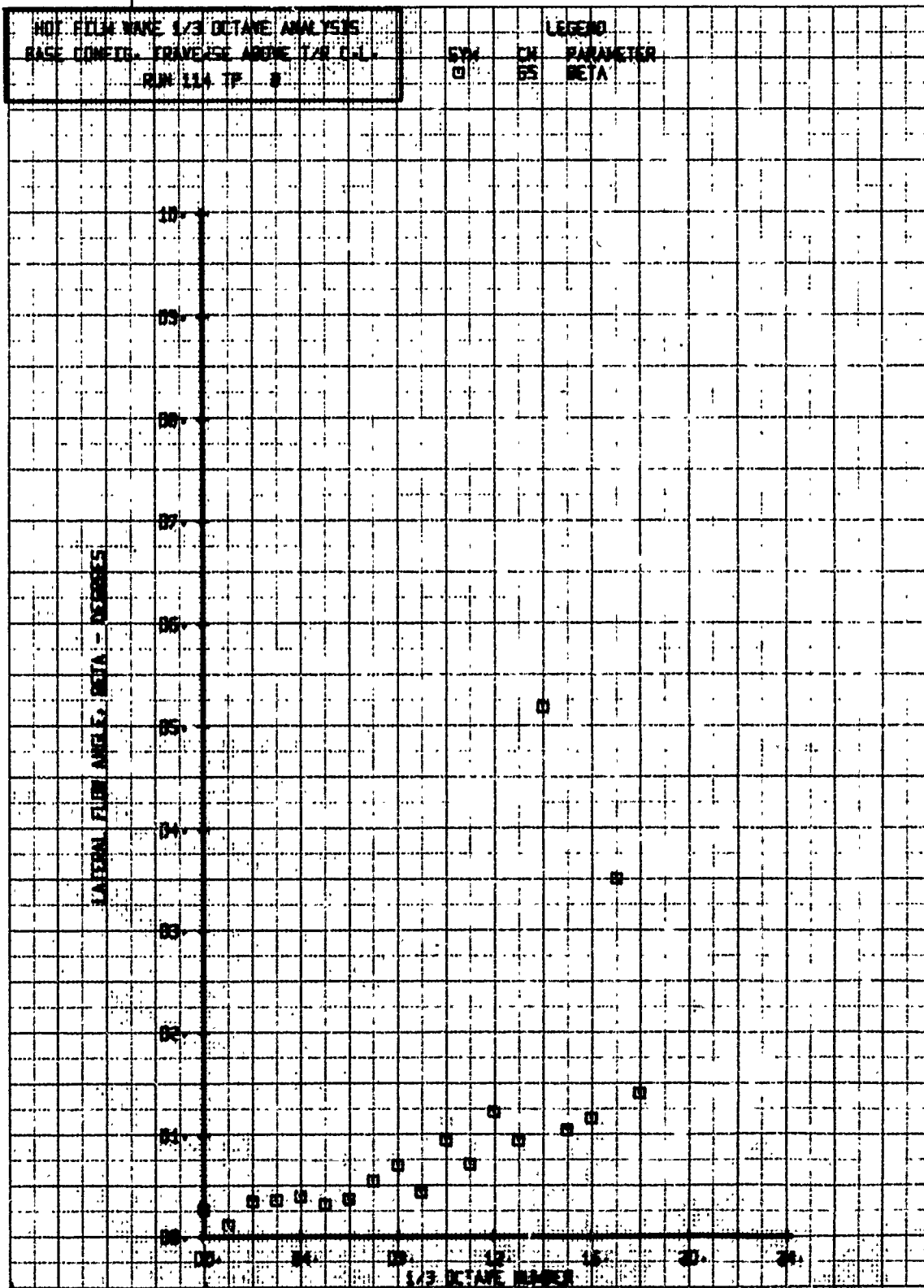




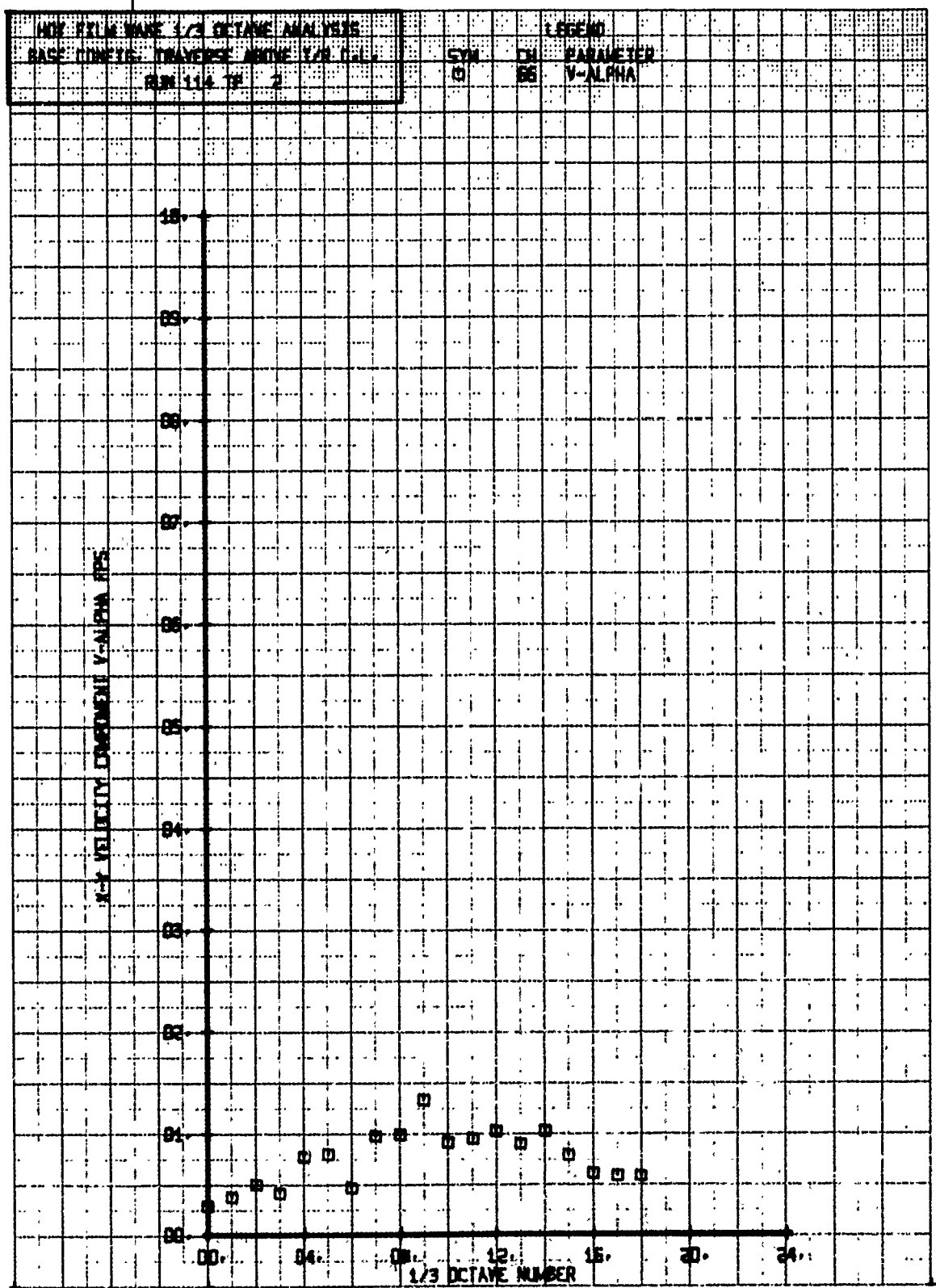


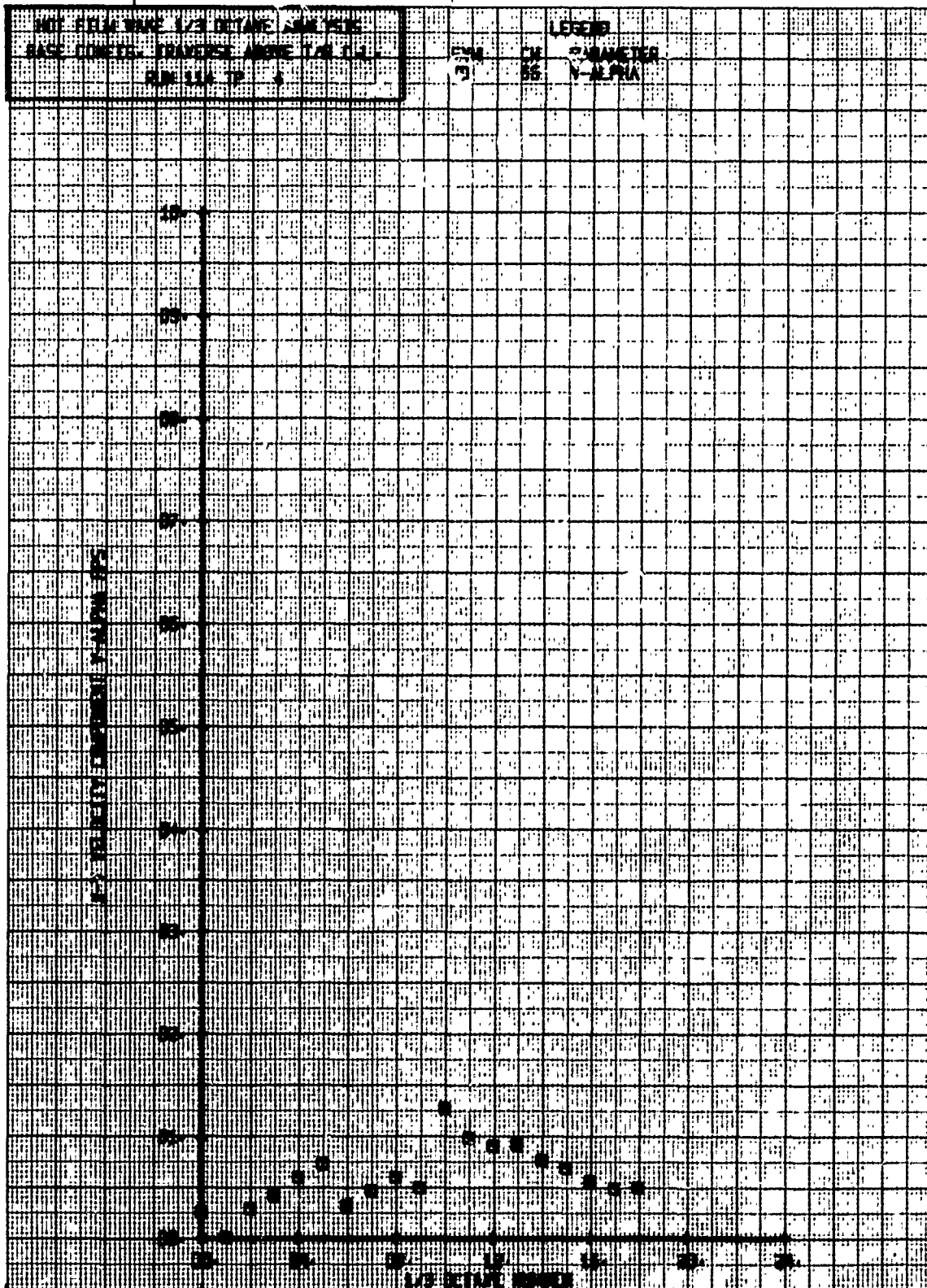


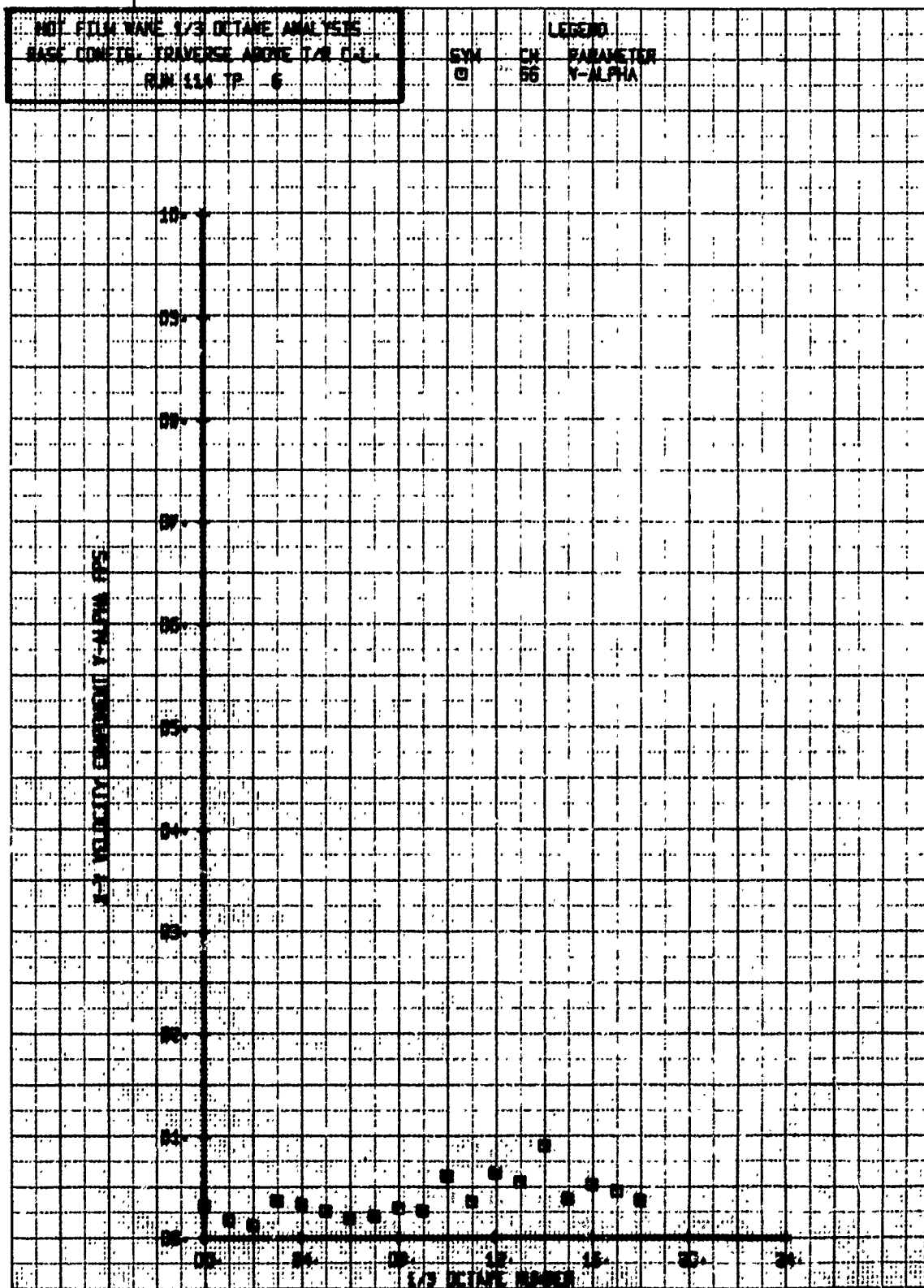




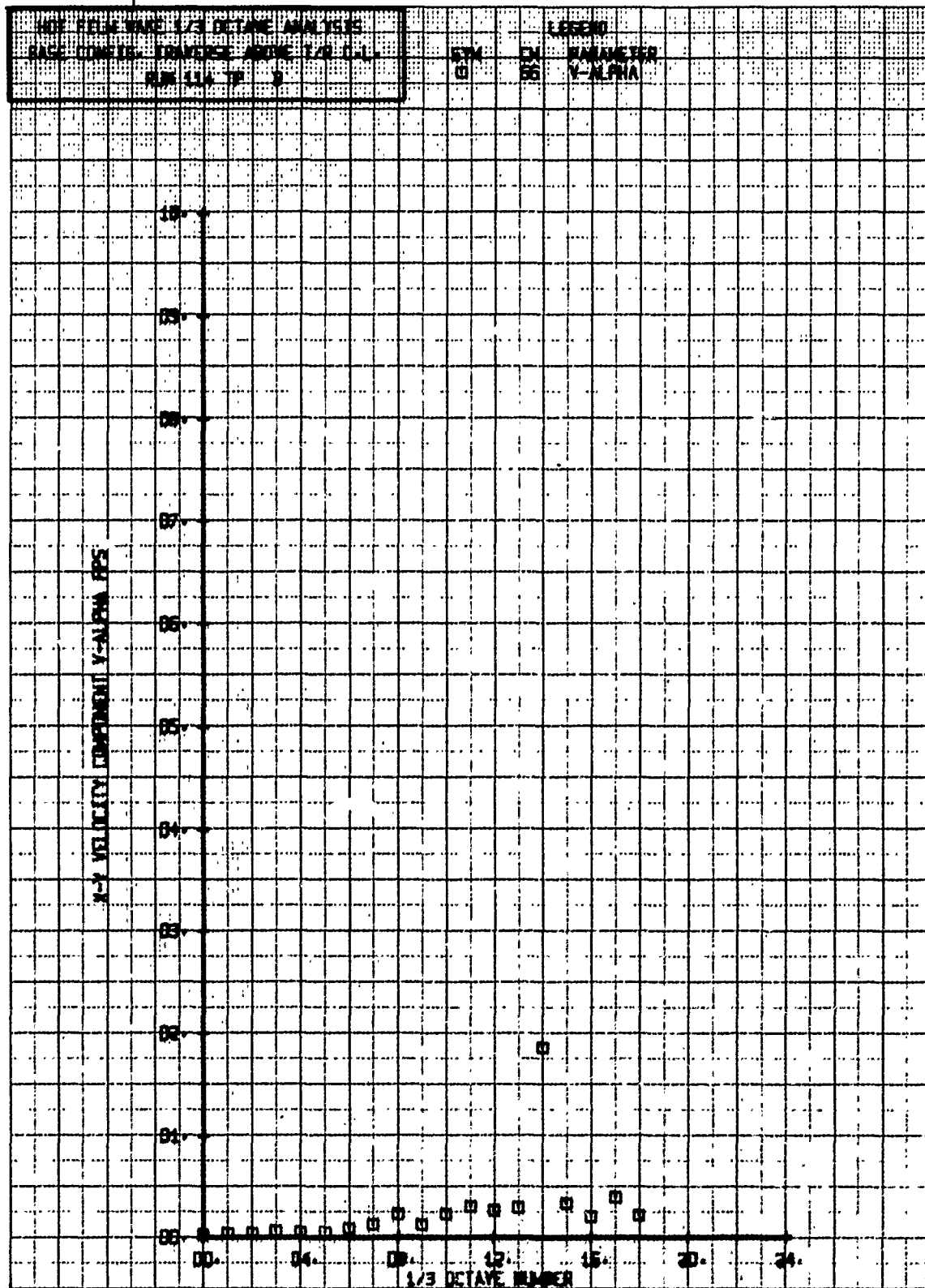






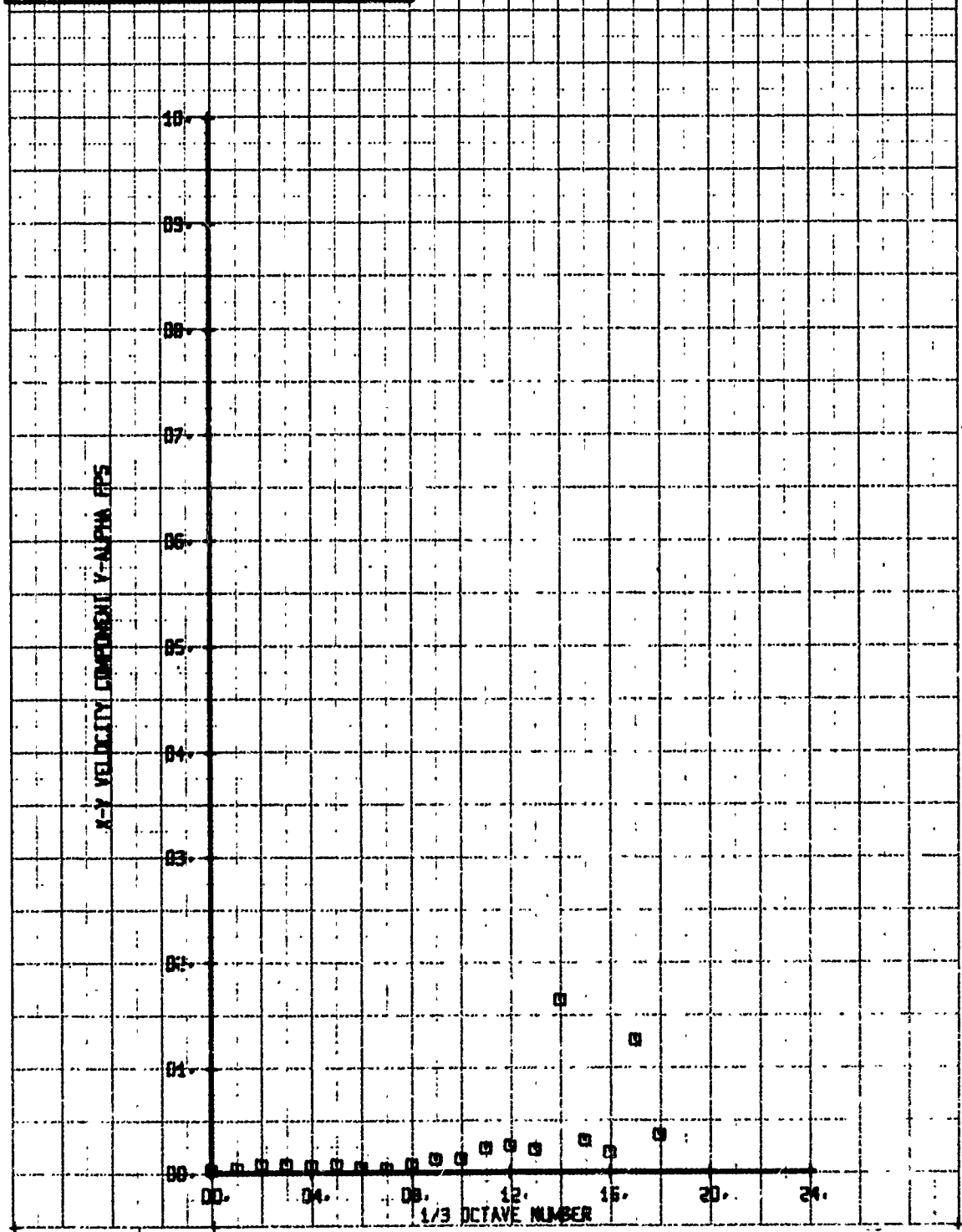


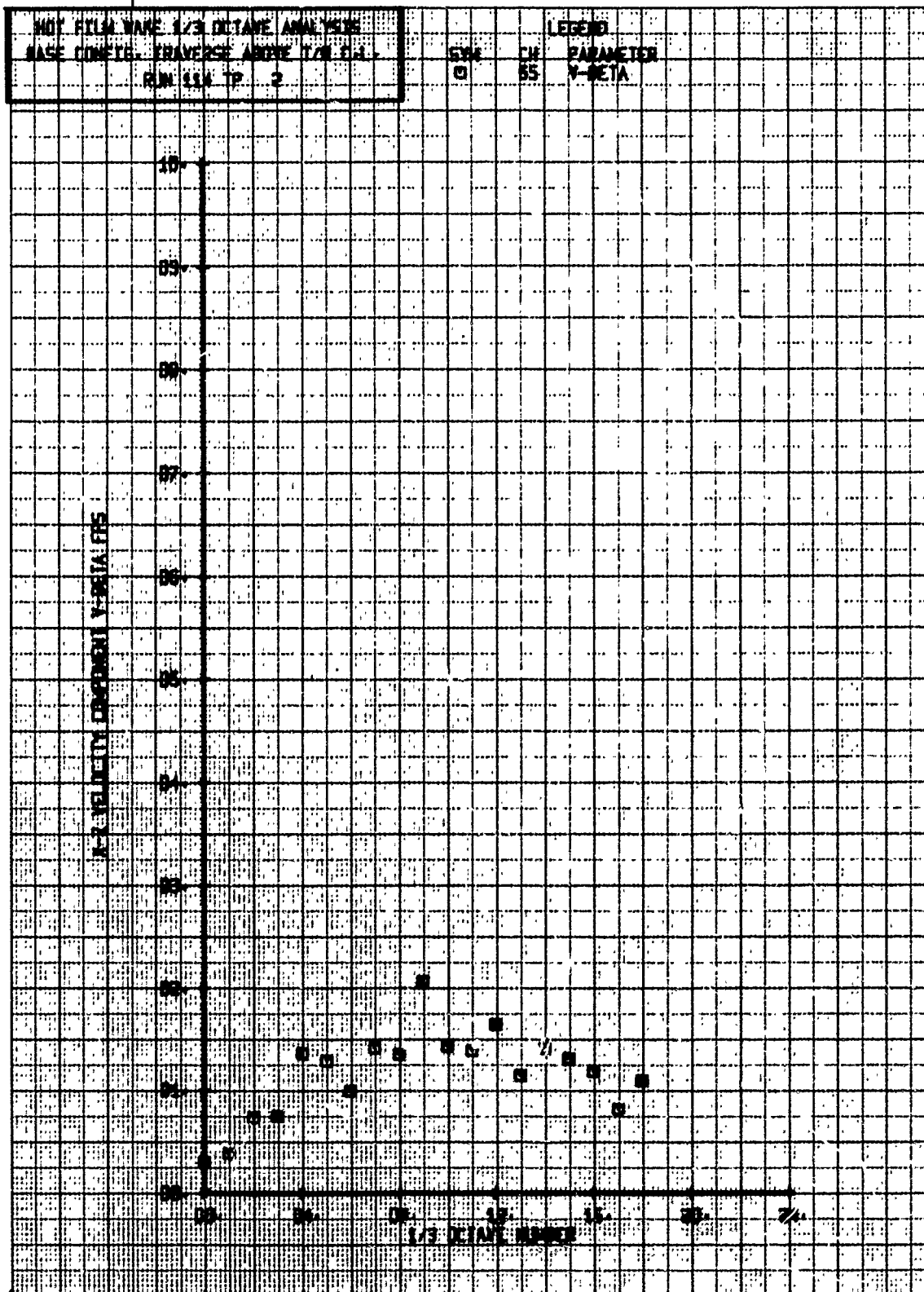




HGT. FILM WAKE 1/3 OCTAVE ANALYSIS  
 BASE CONE 16, TRAVERSE ABOVE 1/2 H. L.  
 RUN 114 TP 10

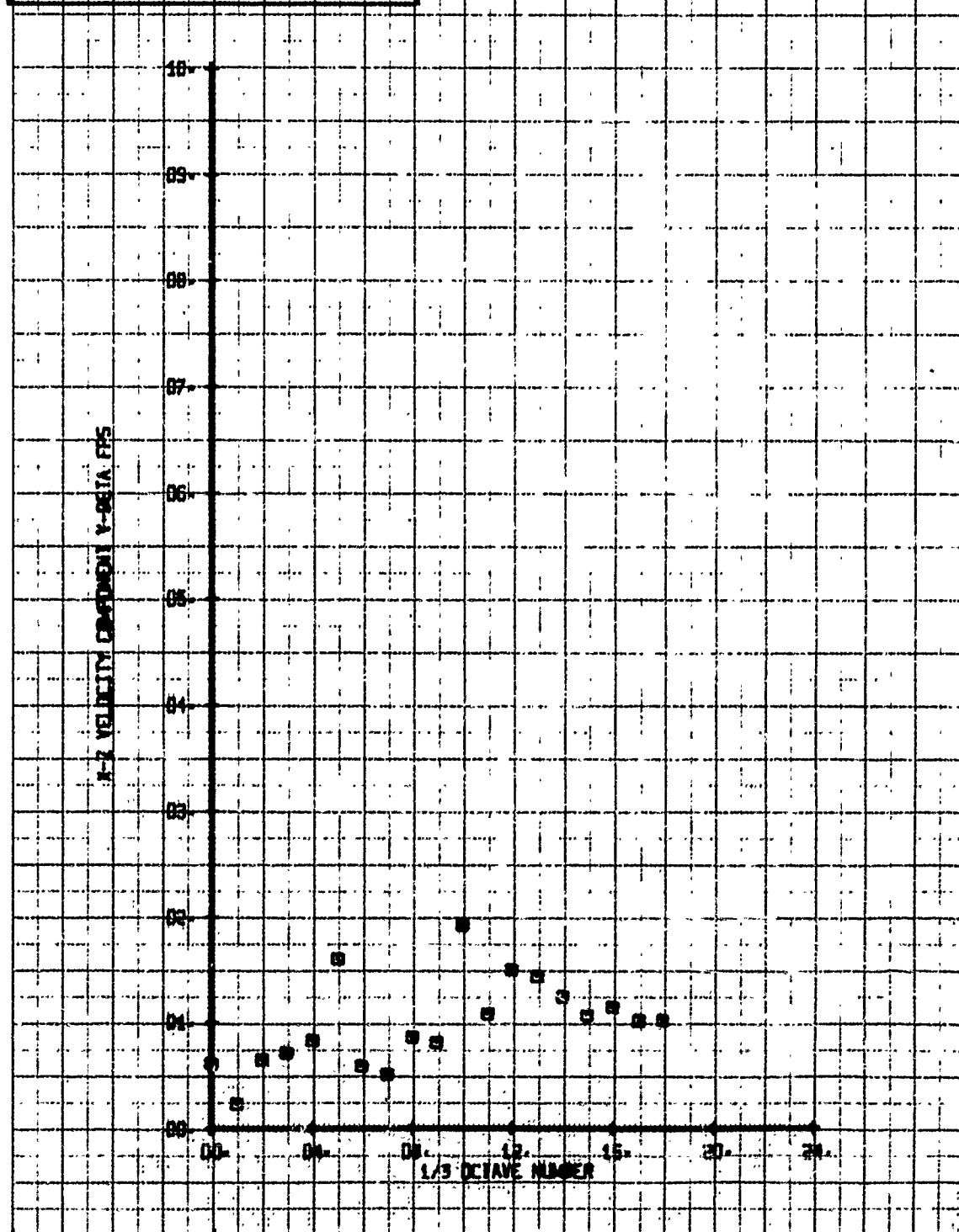
LEGEND  
 CH 56  
 PARAMETER  
 Y-ALPHA

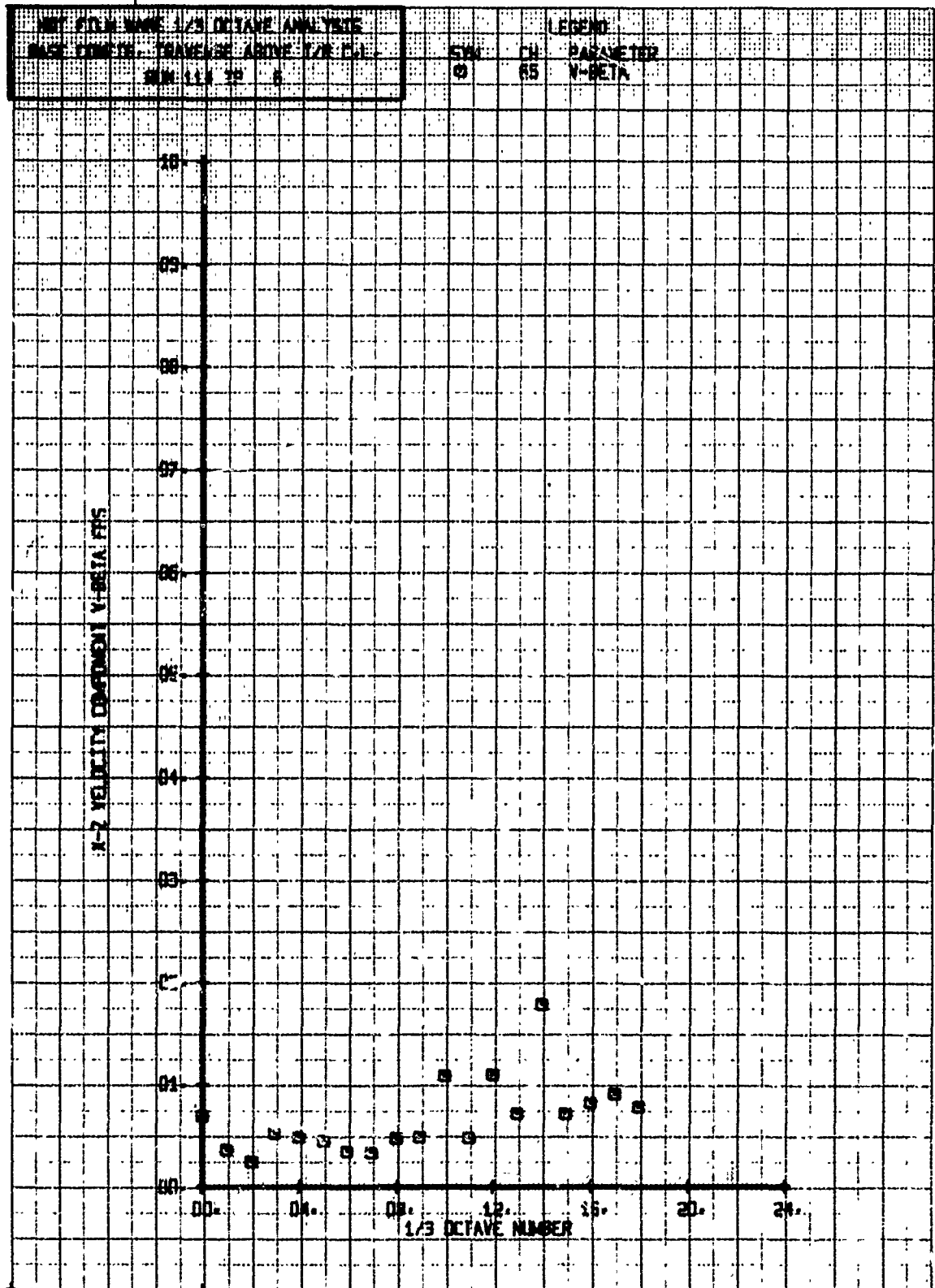


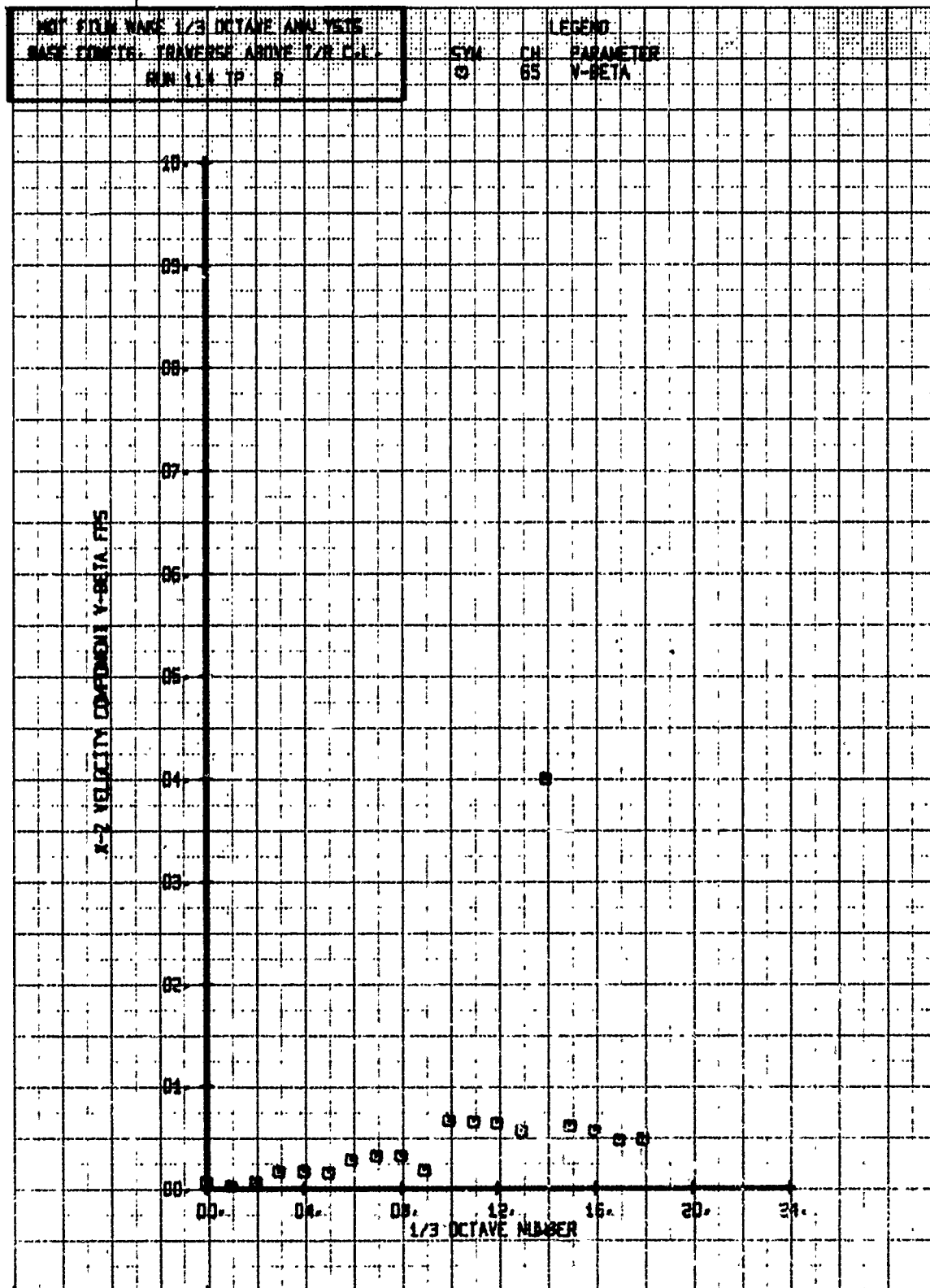


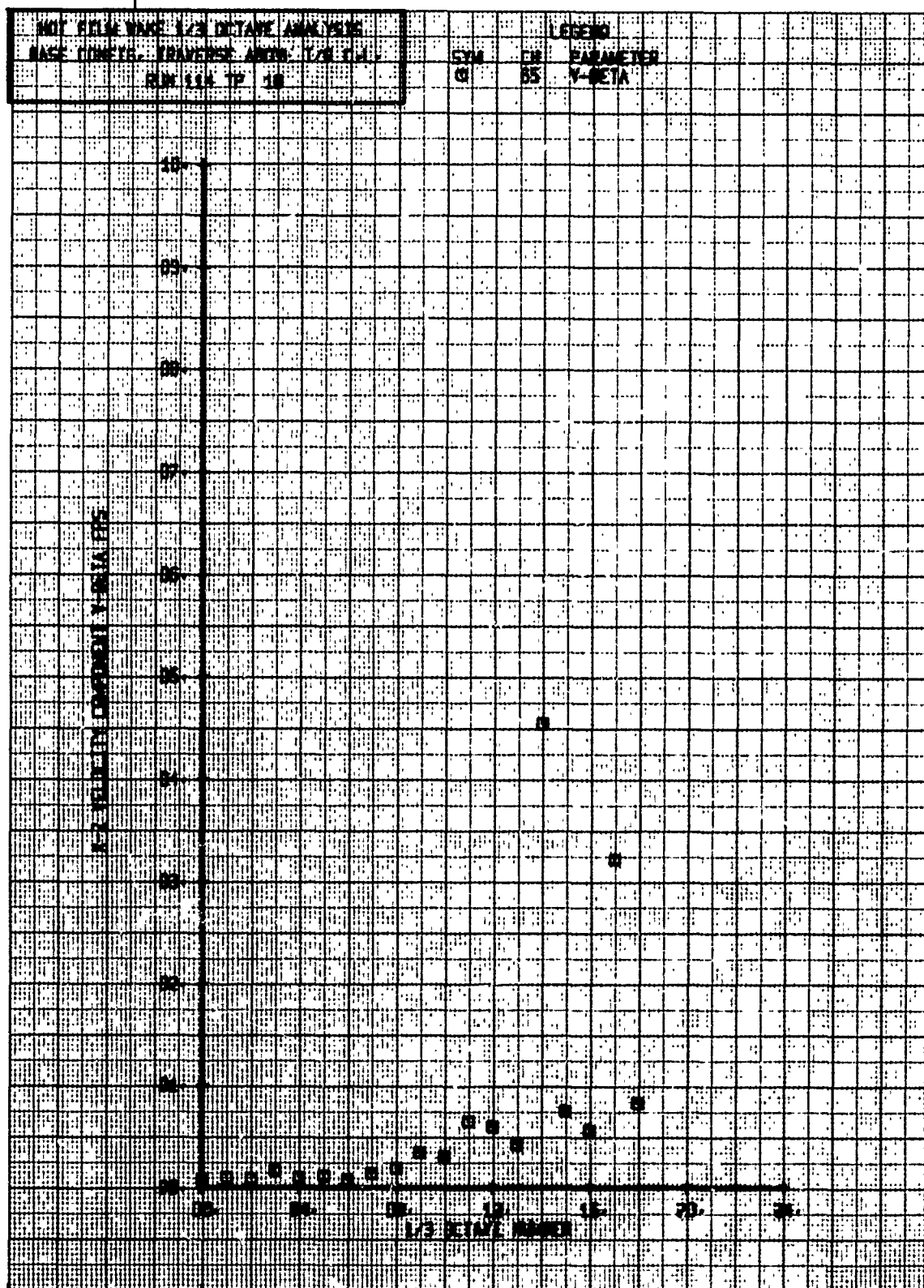
NOT FILM WARE 1/3 OCTAVE ANALYSIS  
 BASE COMETE. TRAVERSE ABOVE 1/8 C.I.  
 RUN 114 TP 4

SYN CH  
 0 65  
 LEGEND  
 PARAMETER  
 V-BETA







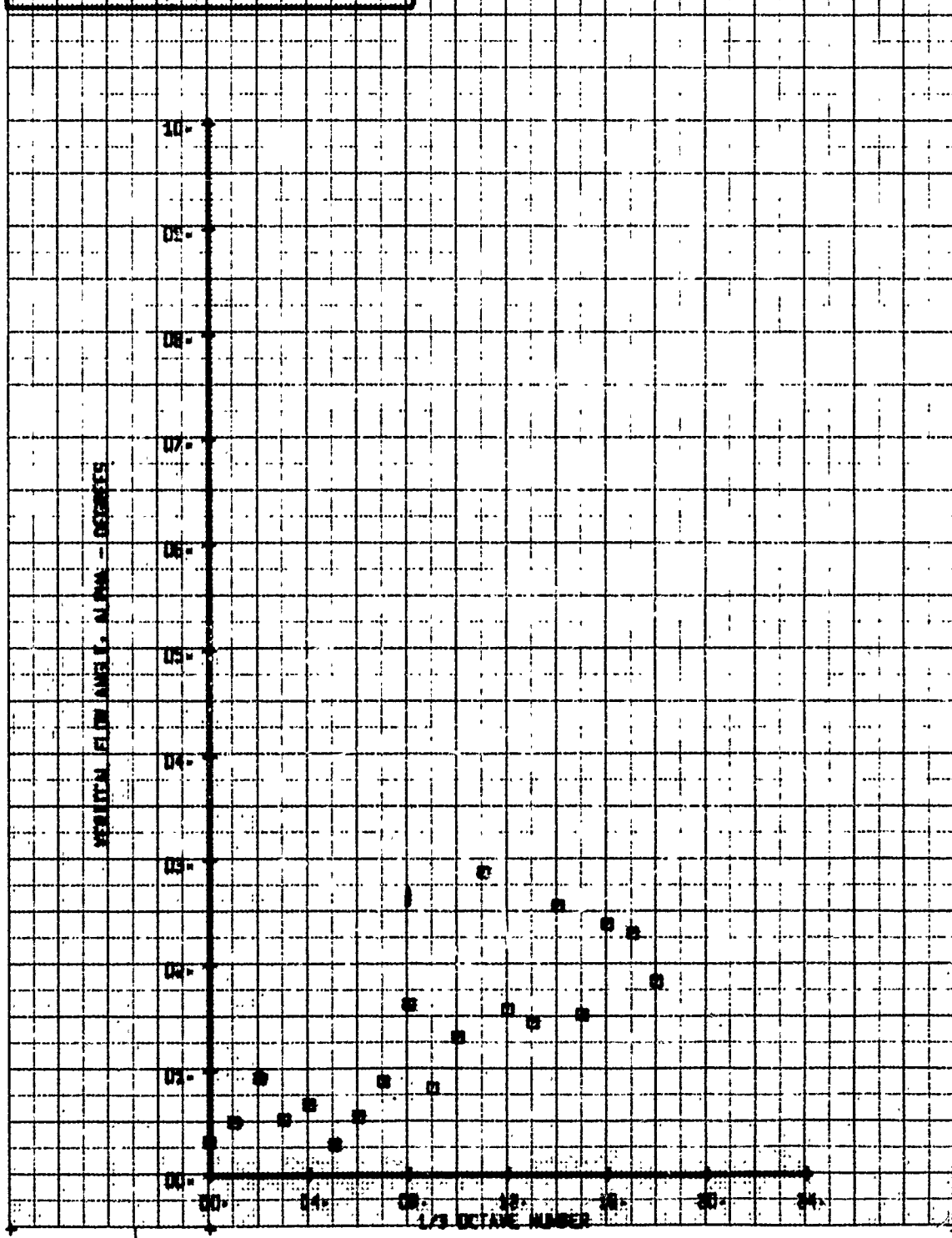


HOT FILM WIRE 1/3 OCTAVE ANALYSIS  
 BASE CONFIG. TRANSVERSE BEHIND STAB  
 RUN 125 TP. 3

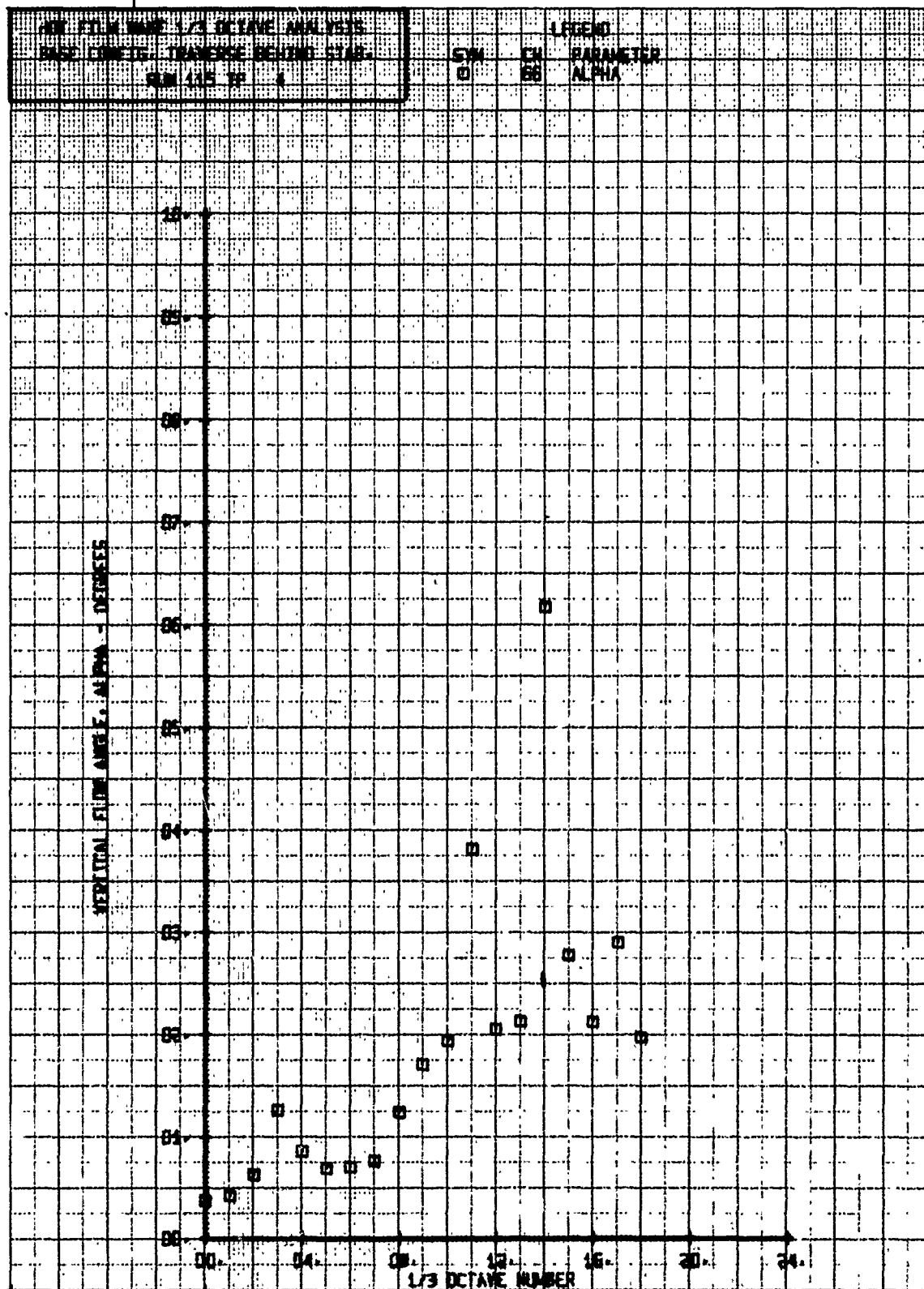
SYN  
 □

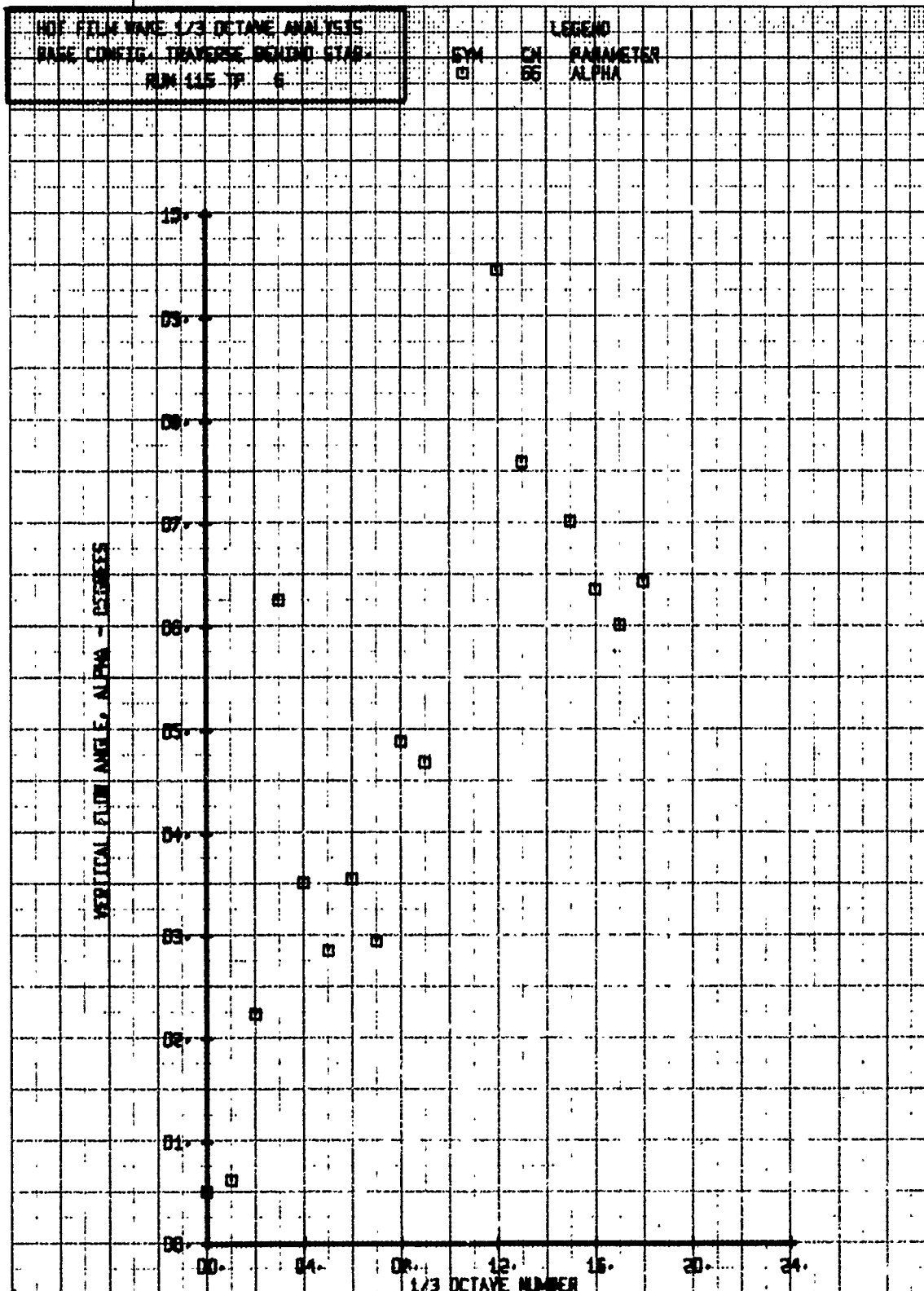
LEGEND  
 CH 66  
 PARAMETER  
 ALPHA

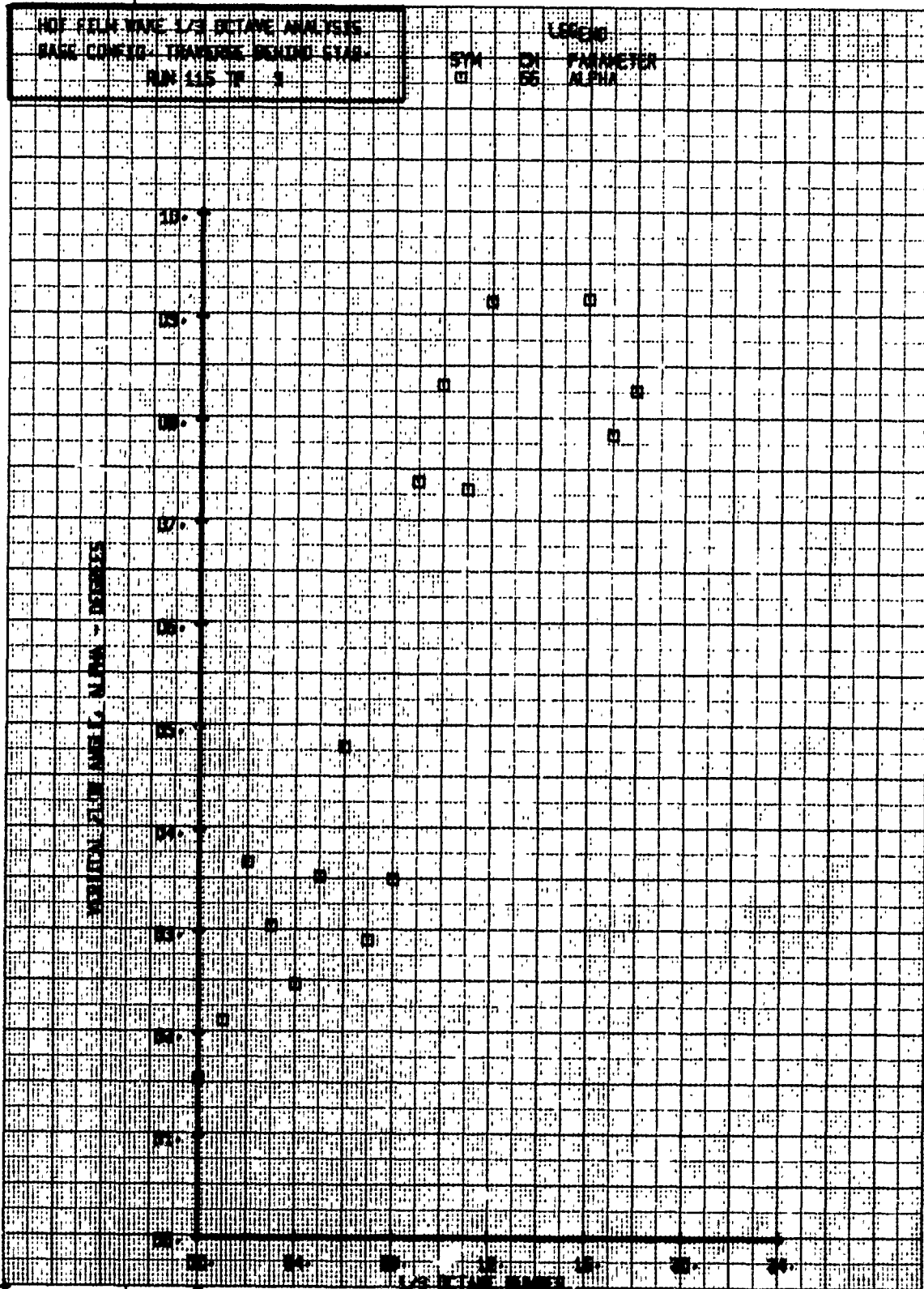
VERTICAL FLOW ANGLE, ALPHA - DEGREES

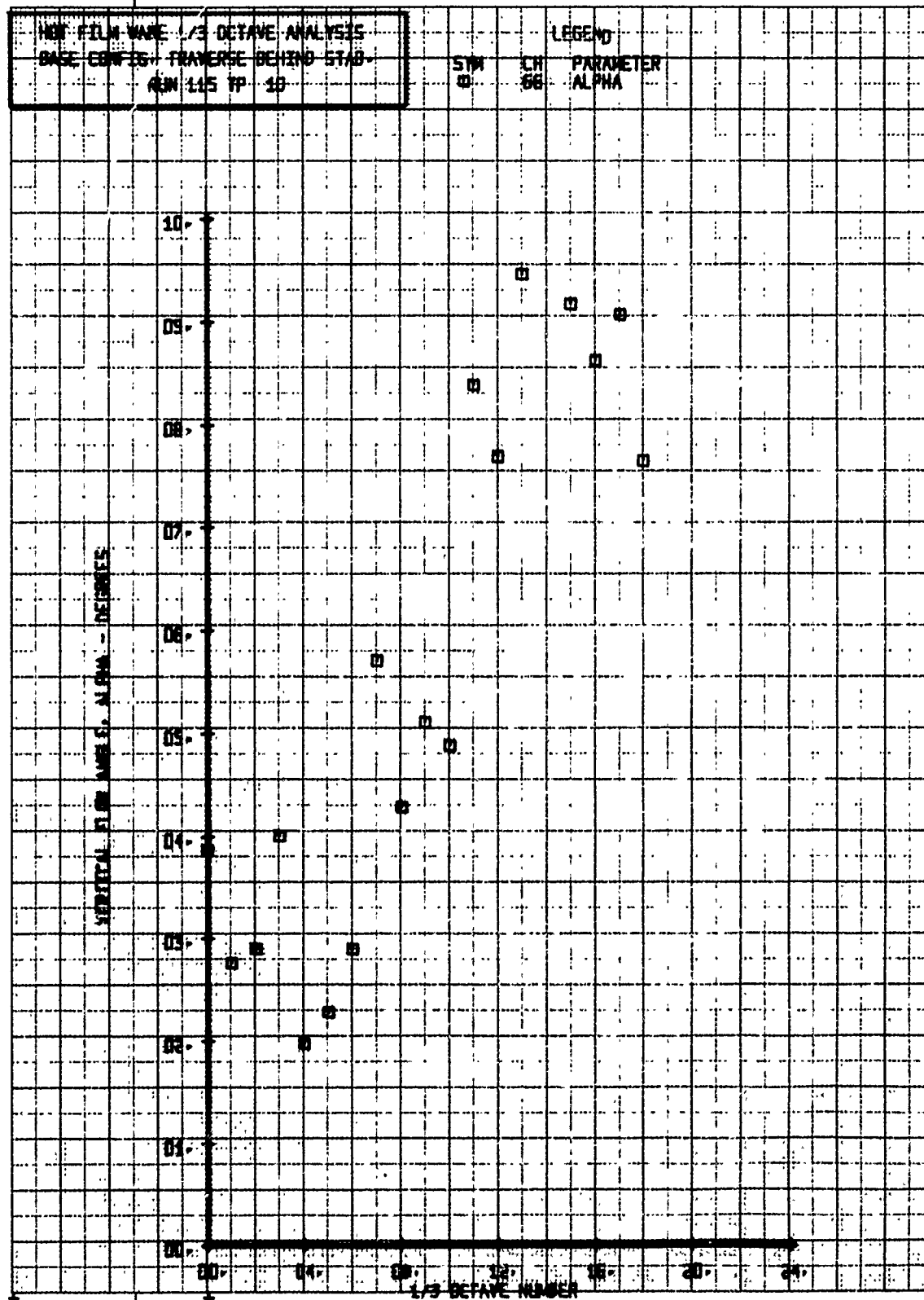




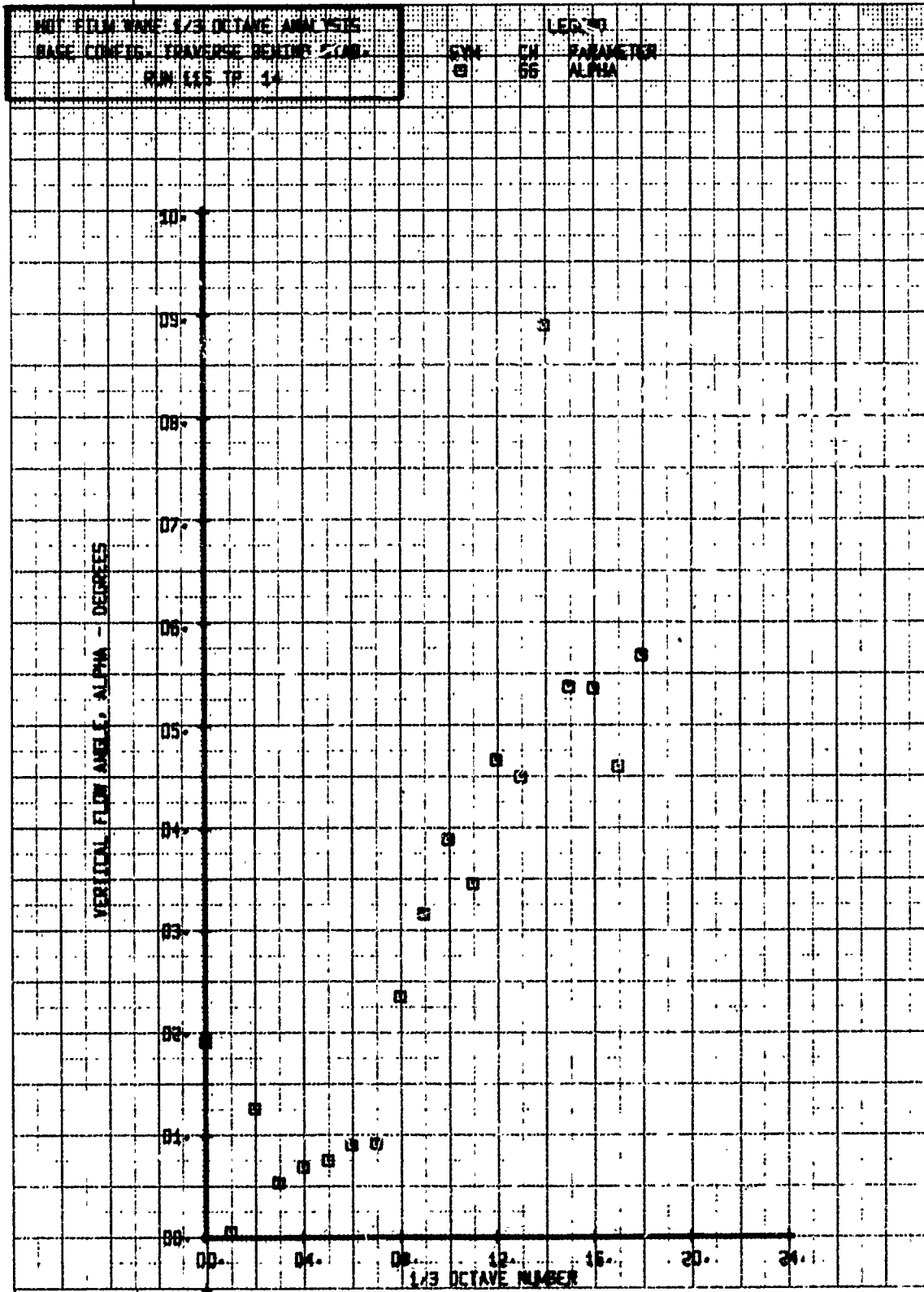


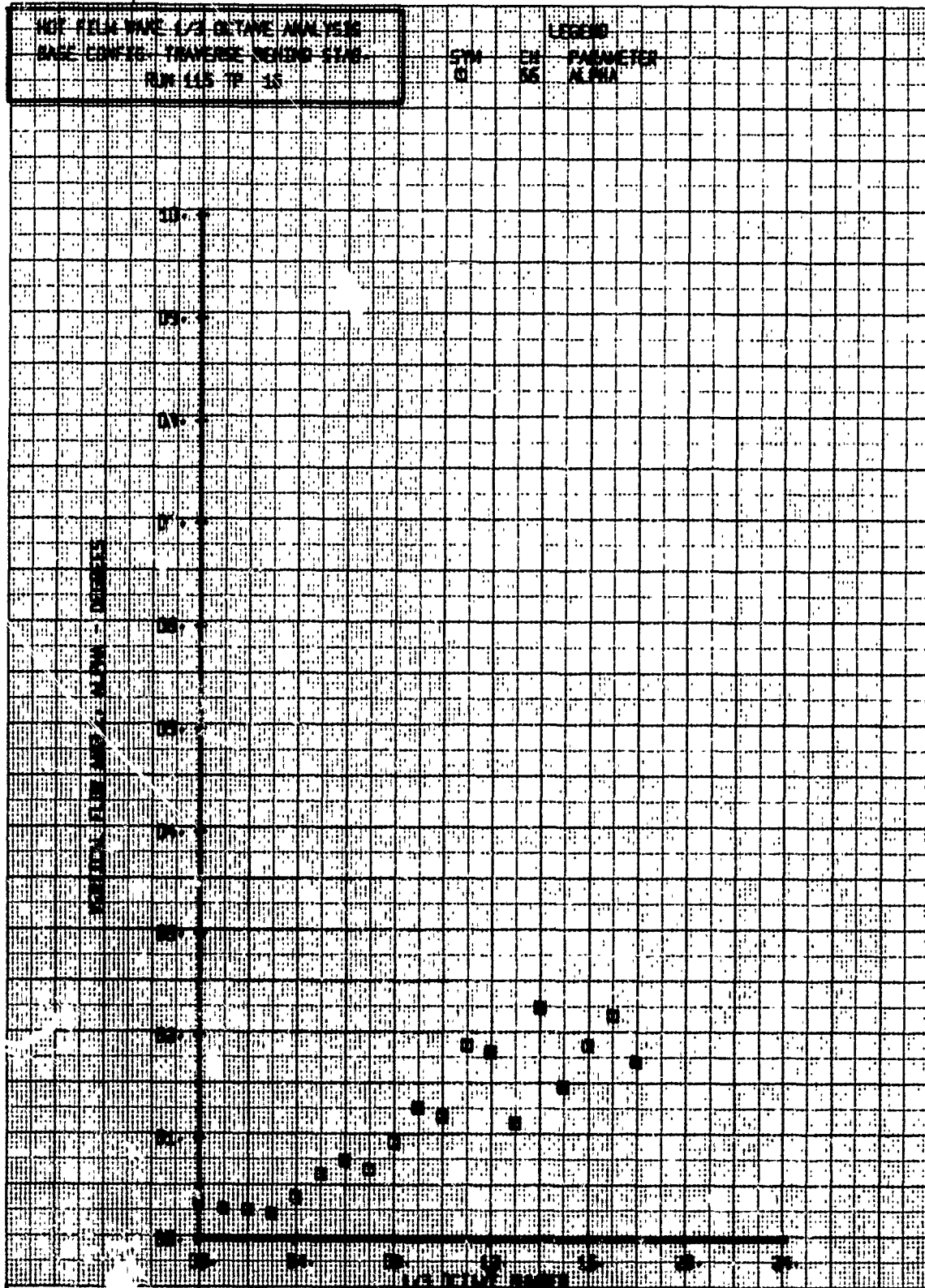


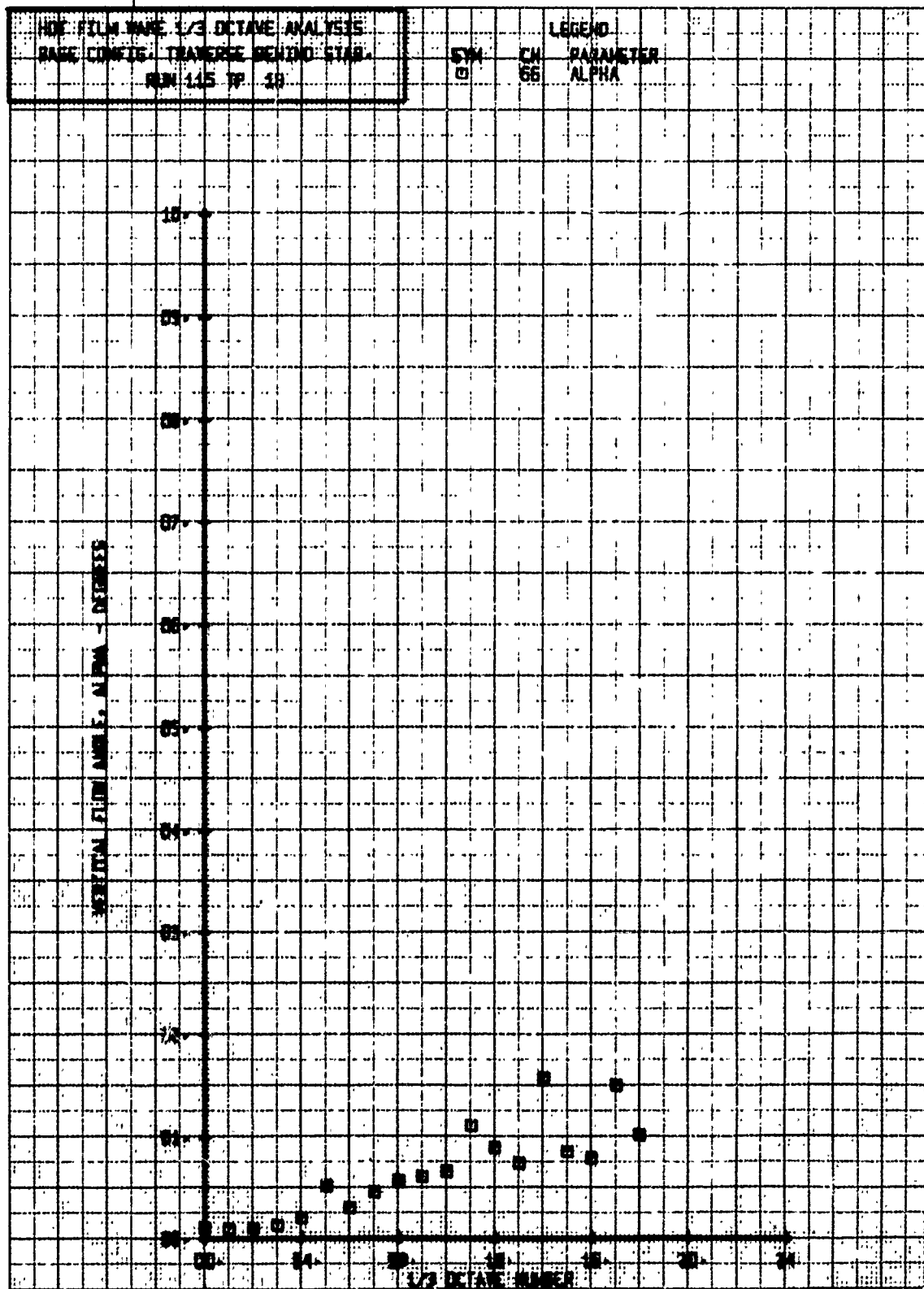






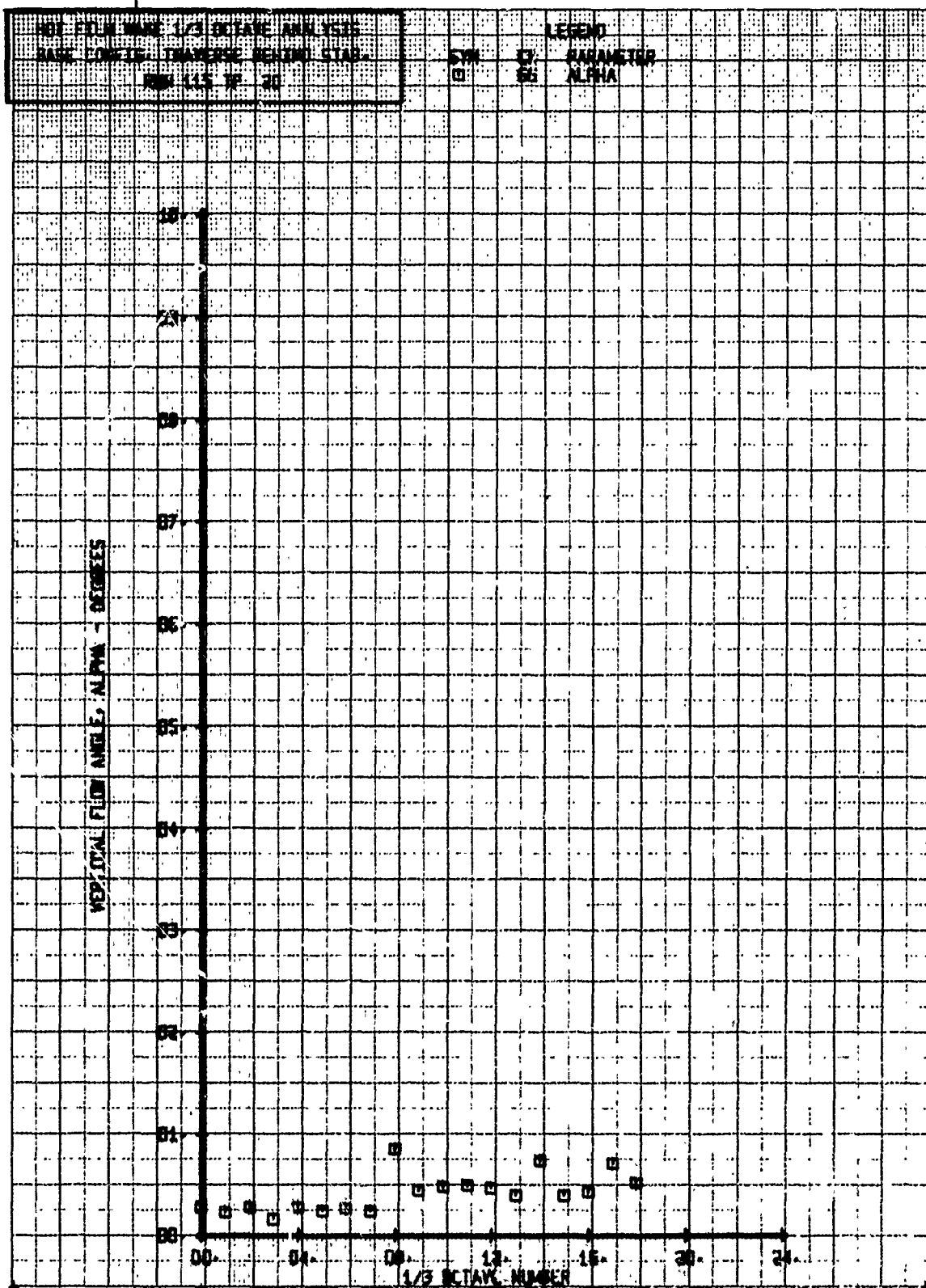


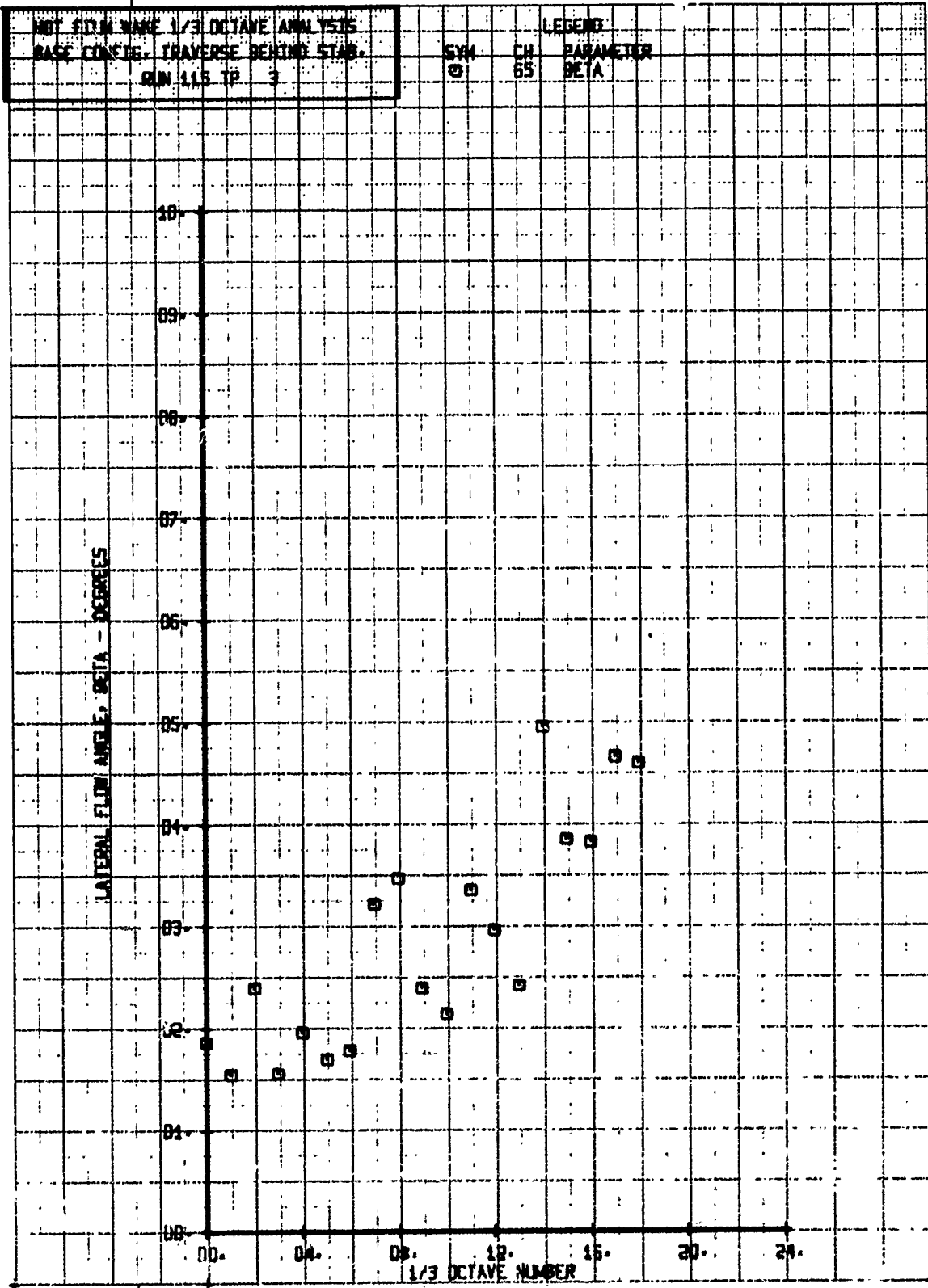






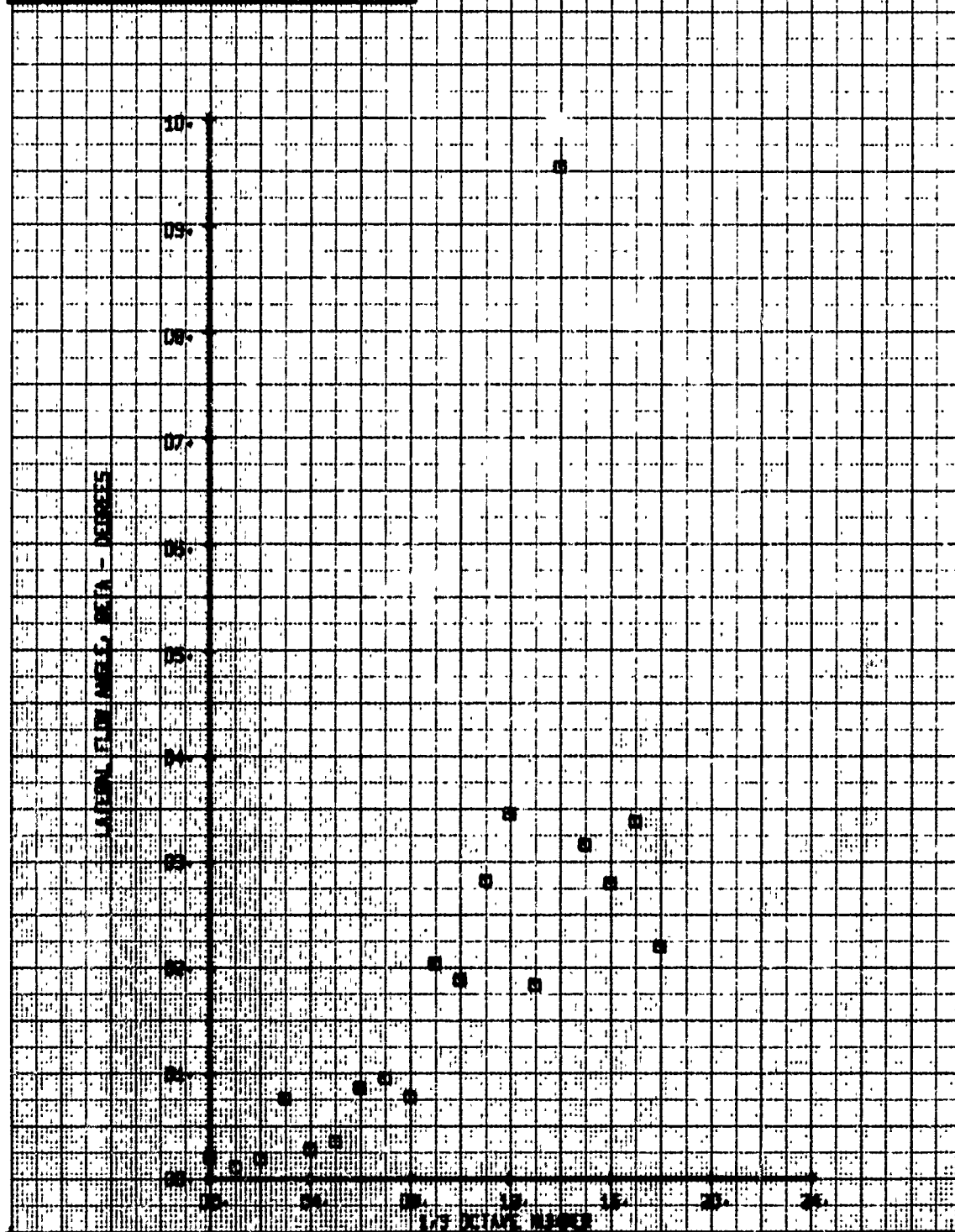
LEGEND  
PARAMETER  
ALPHA

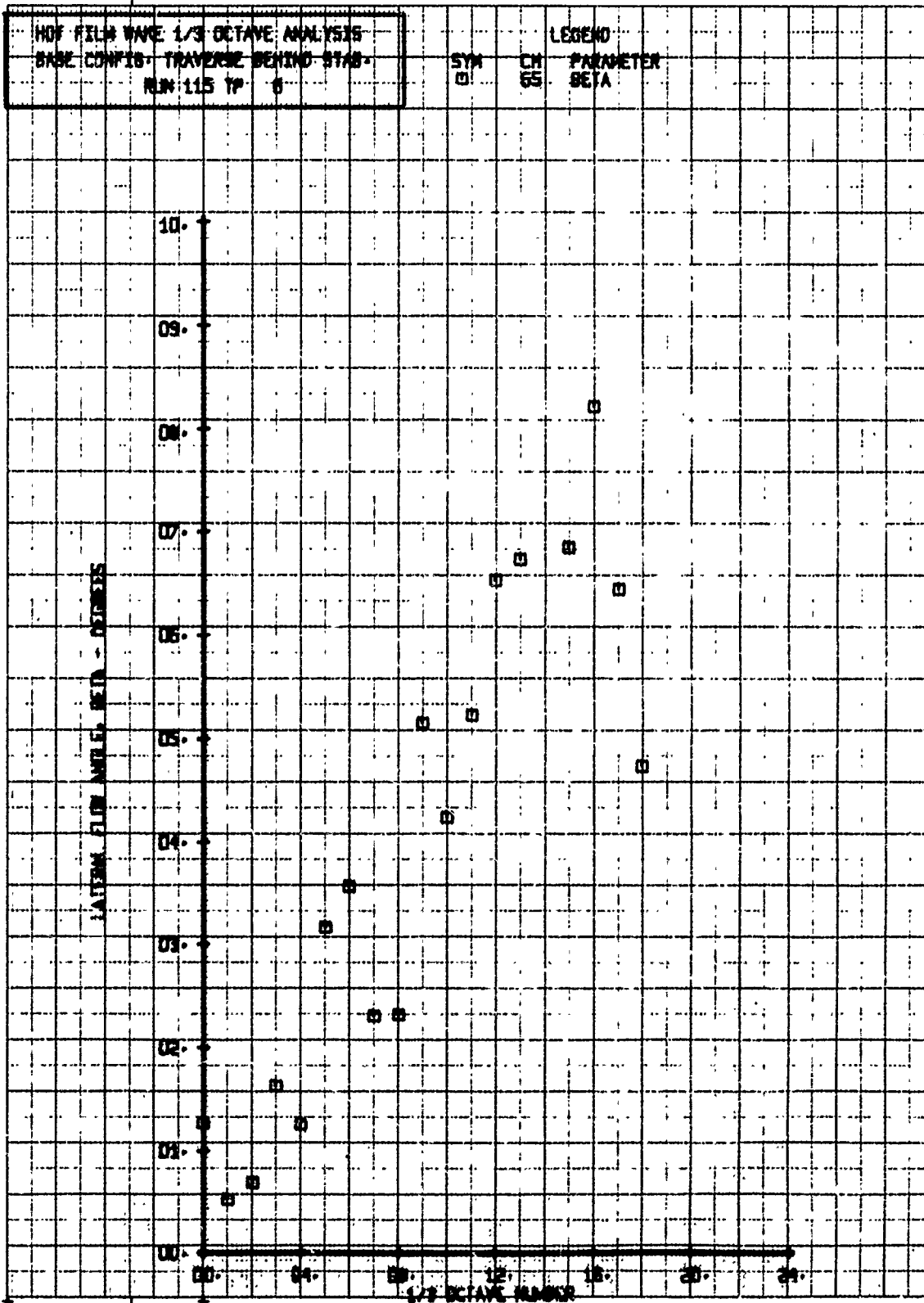


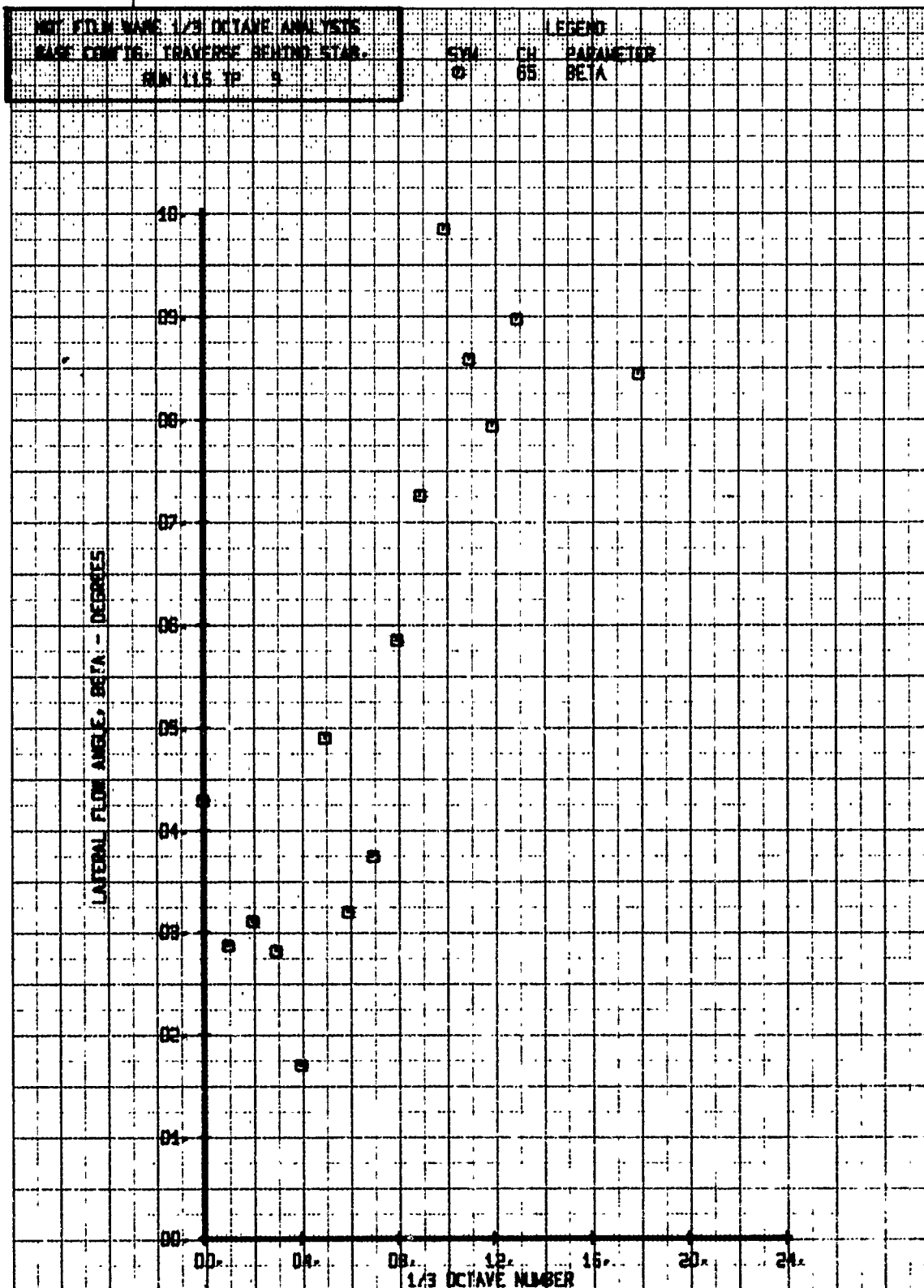


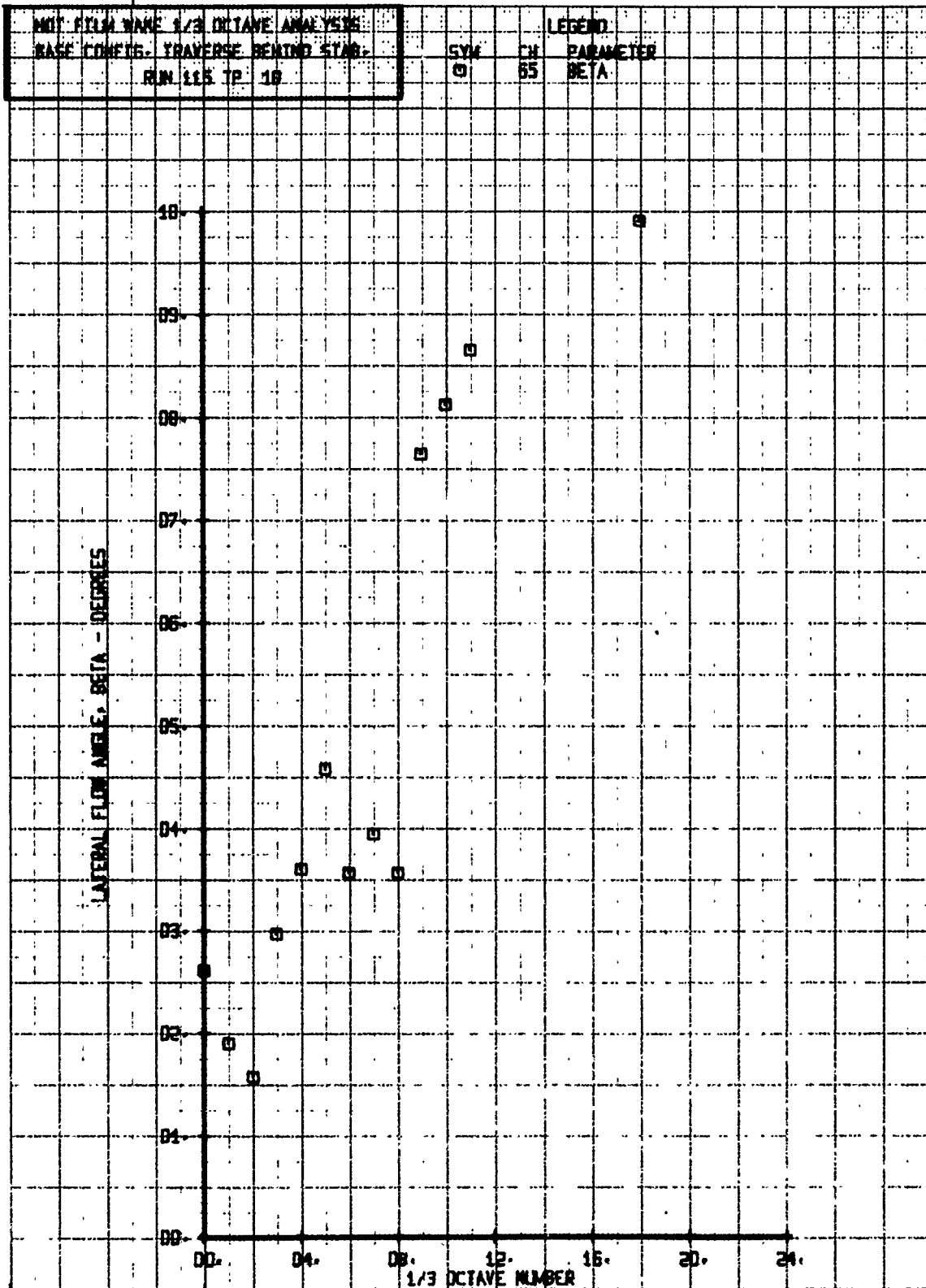
NOT FILM WAVE 1/3 OCTAVE ANALYSIS  
 BASE CORRECTED TRAVERSE PERIOD STAB.  
 RUN 115 TP 4

LEGEND  
 CH 65  
 PARAMETER  
 BETA





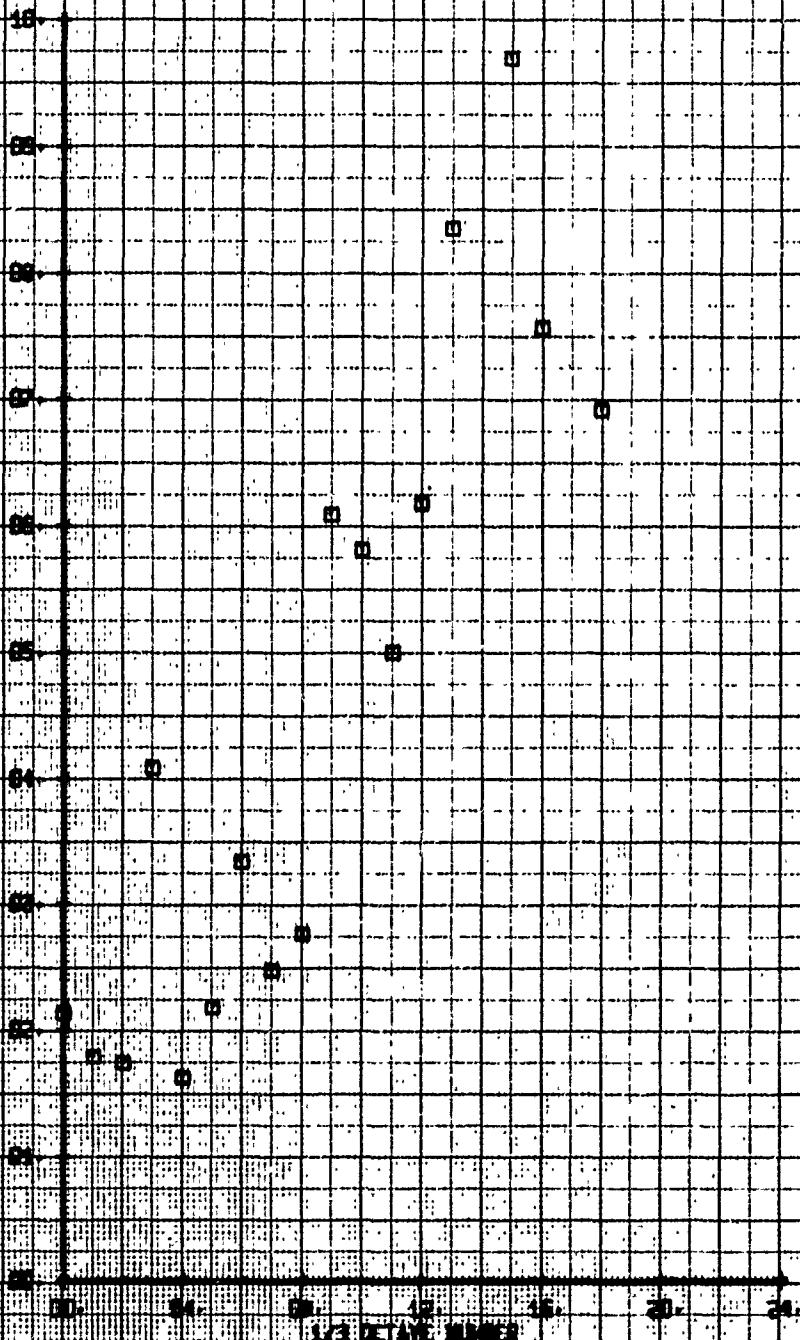




NOV FILM WAVE 1/3 OCTAVE ANALYSIS  
 BASE CONTE. TRAVERSE RESIDUAL SYM.  
 RUN 115 TP 12

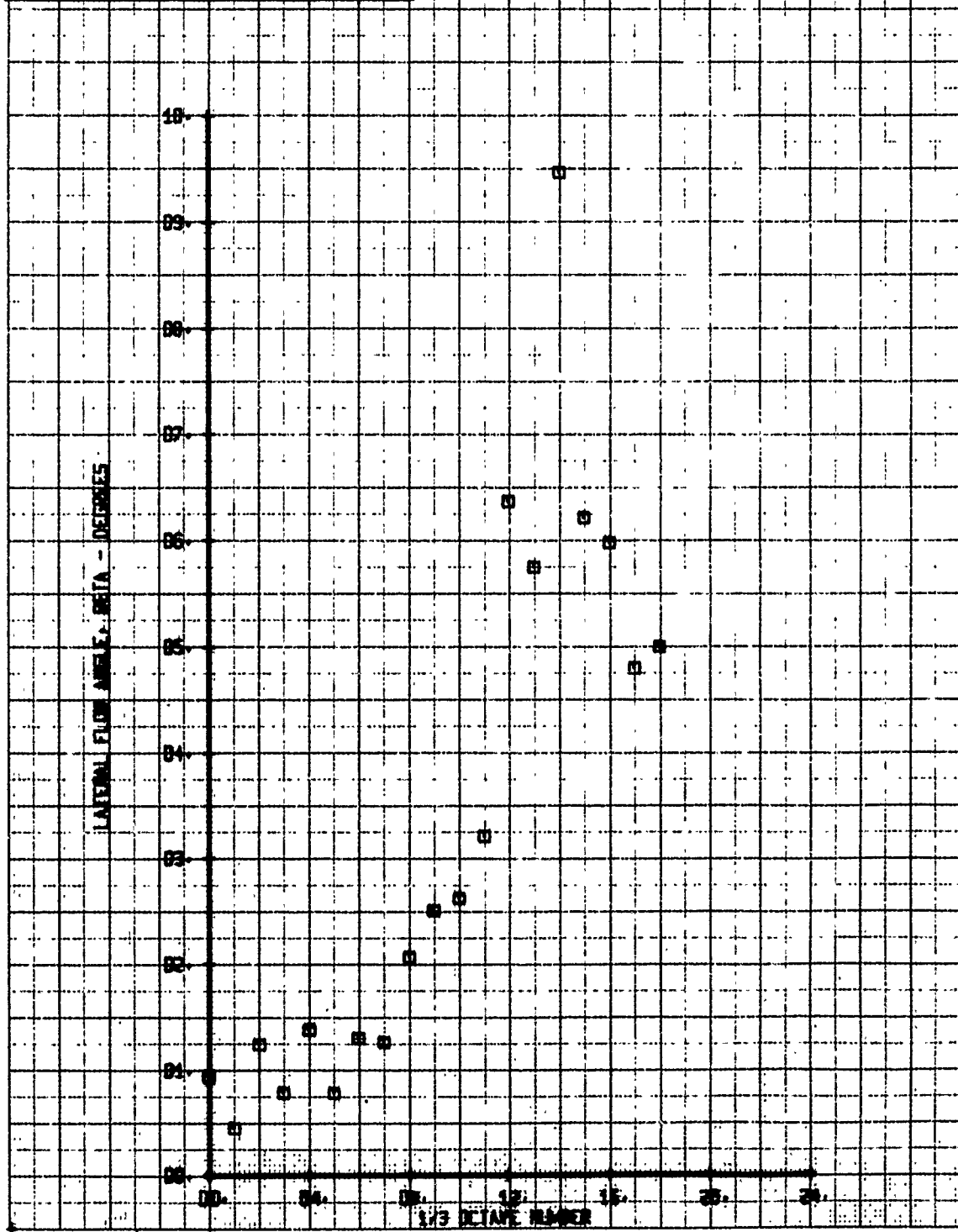
SYN CH  
 0 05  
 LEGEND  
 PARAMETER  
 MEFA

LATENT FINGER PRINTS - INTENSITIES



NOI FILM WAKE 1/3 OCTAVE ANALYSIS  
 BASE CONFIG. TRAVERSE BENDING SYM.  
 RUN 115 TP 14

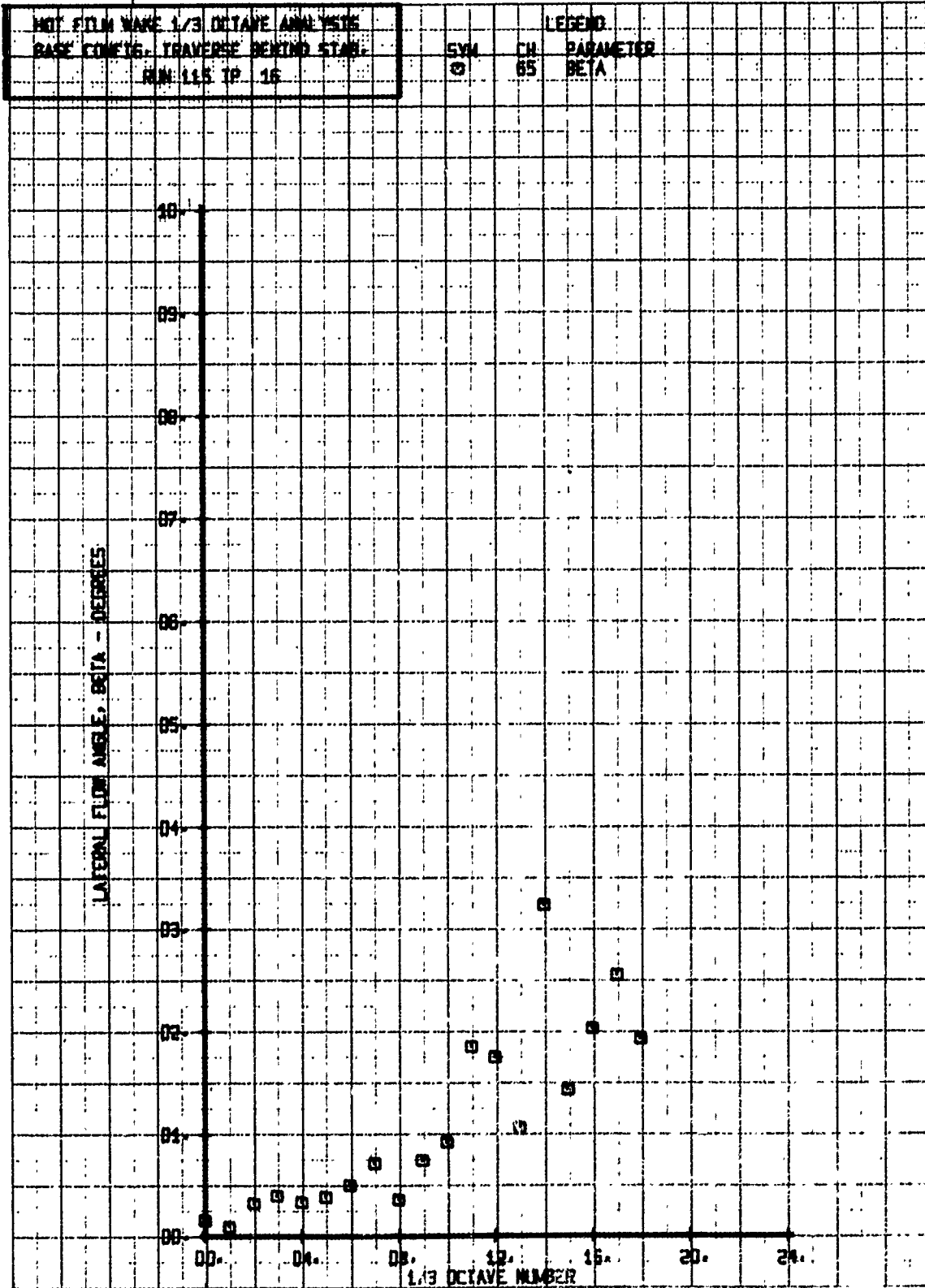
SYM CH  
 0 65  
 LEGEND  
 PARAMETER  
 BETA

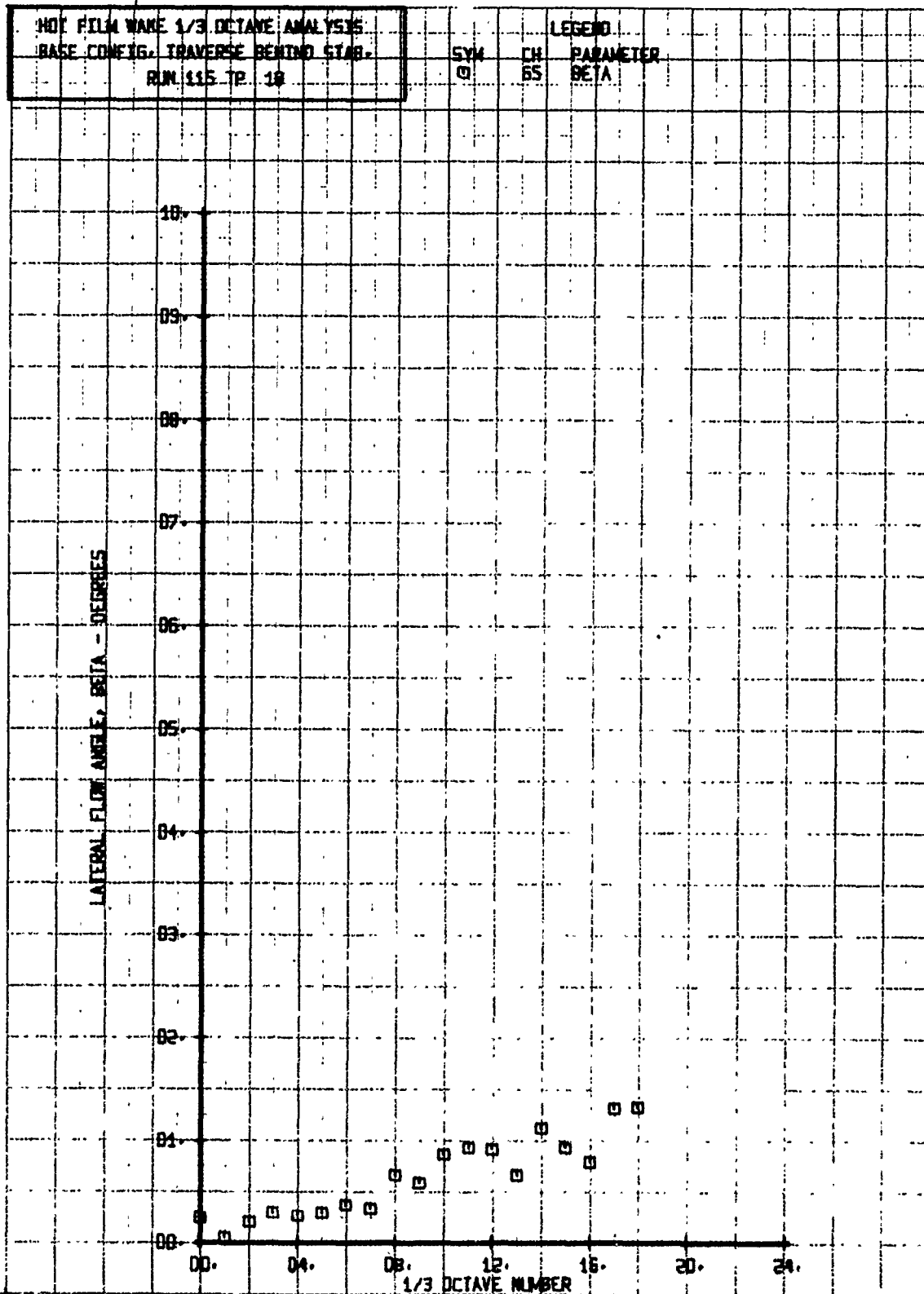




HOT FILM WAKE 1/3 OCTAVE ANALYSIS  
 BASE CONFIG. TRAVERSE BEHIND STAB.  
 RUN 115 TP 16

SYM CH PARAMETER  
 0 65 BETA





HOT FILM WAKE 1/3 OCTAVE ANALYSIS  
 BASE CONFIG. TRAVERSE BEHIND CYAB  
 RUN 115 TP 20

| SYM | CH | PARAMETER |
|-----|----|-----------|
| 0   | 65 | BETA      |

LATERAL FLOW ANGLE, BETA - DEGREES

10

95

90

85

80

75

70

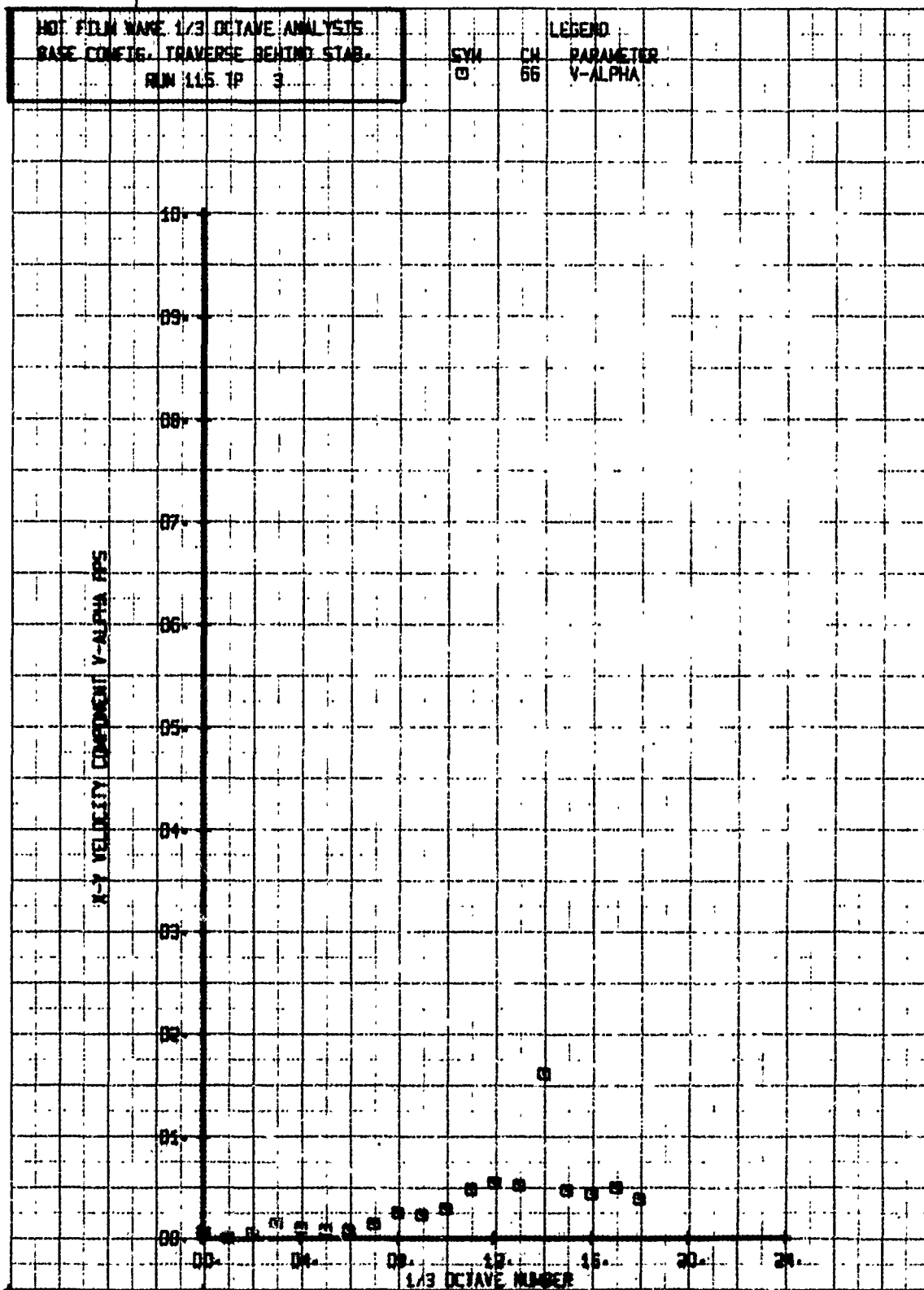
65

60

55

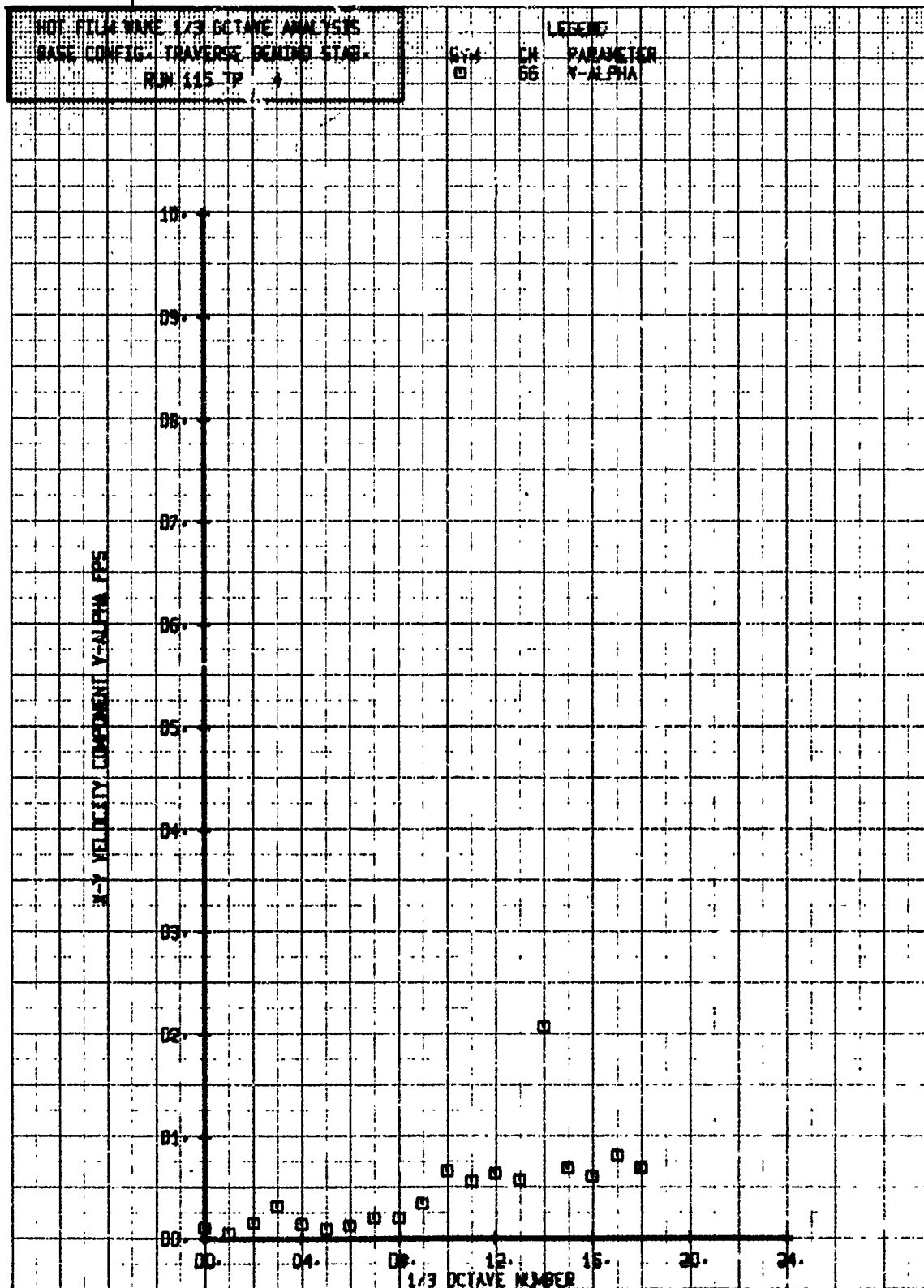
50

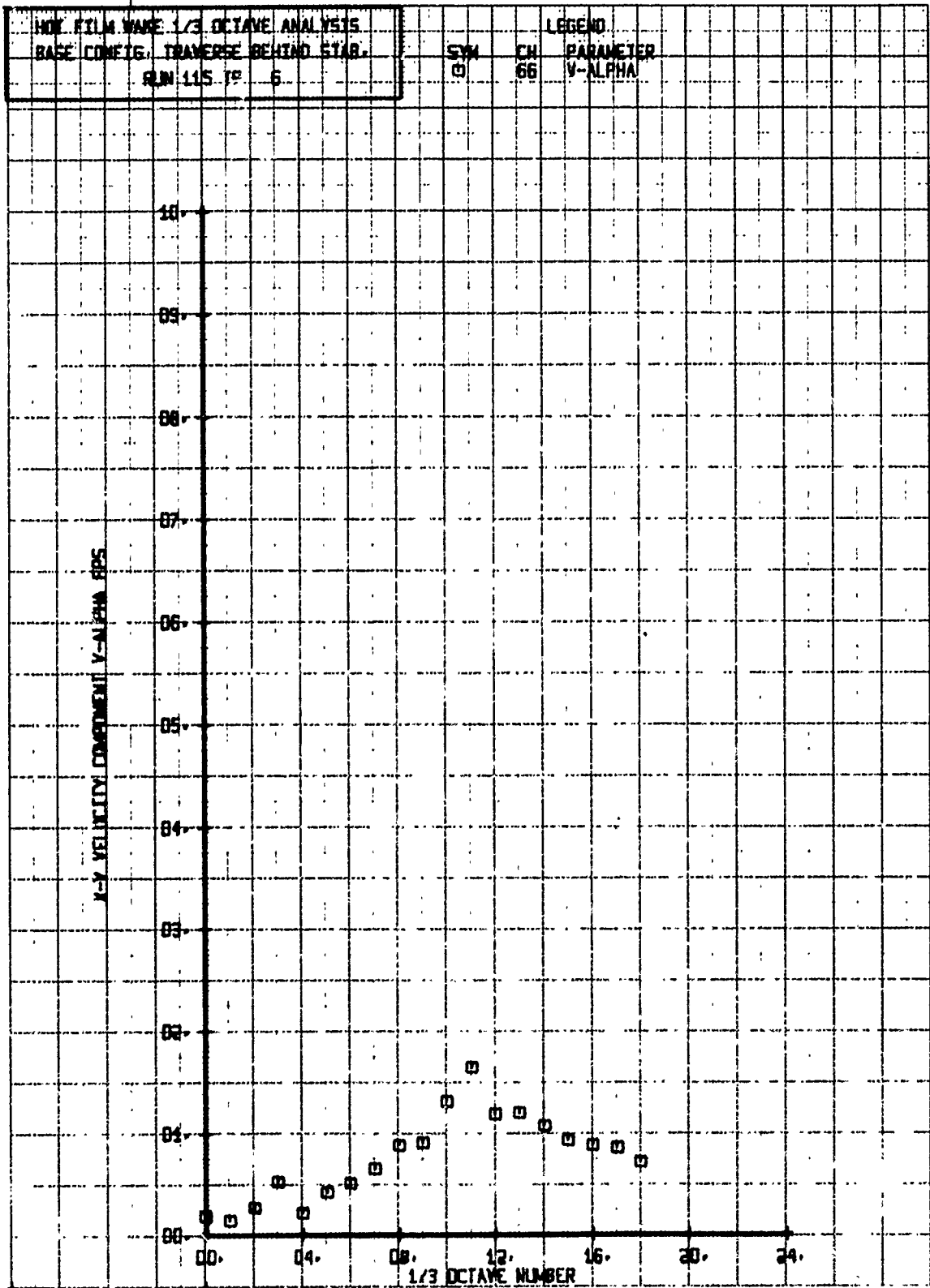
1/3 OCTAVE NUMBER

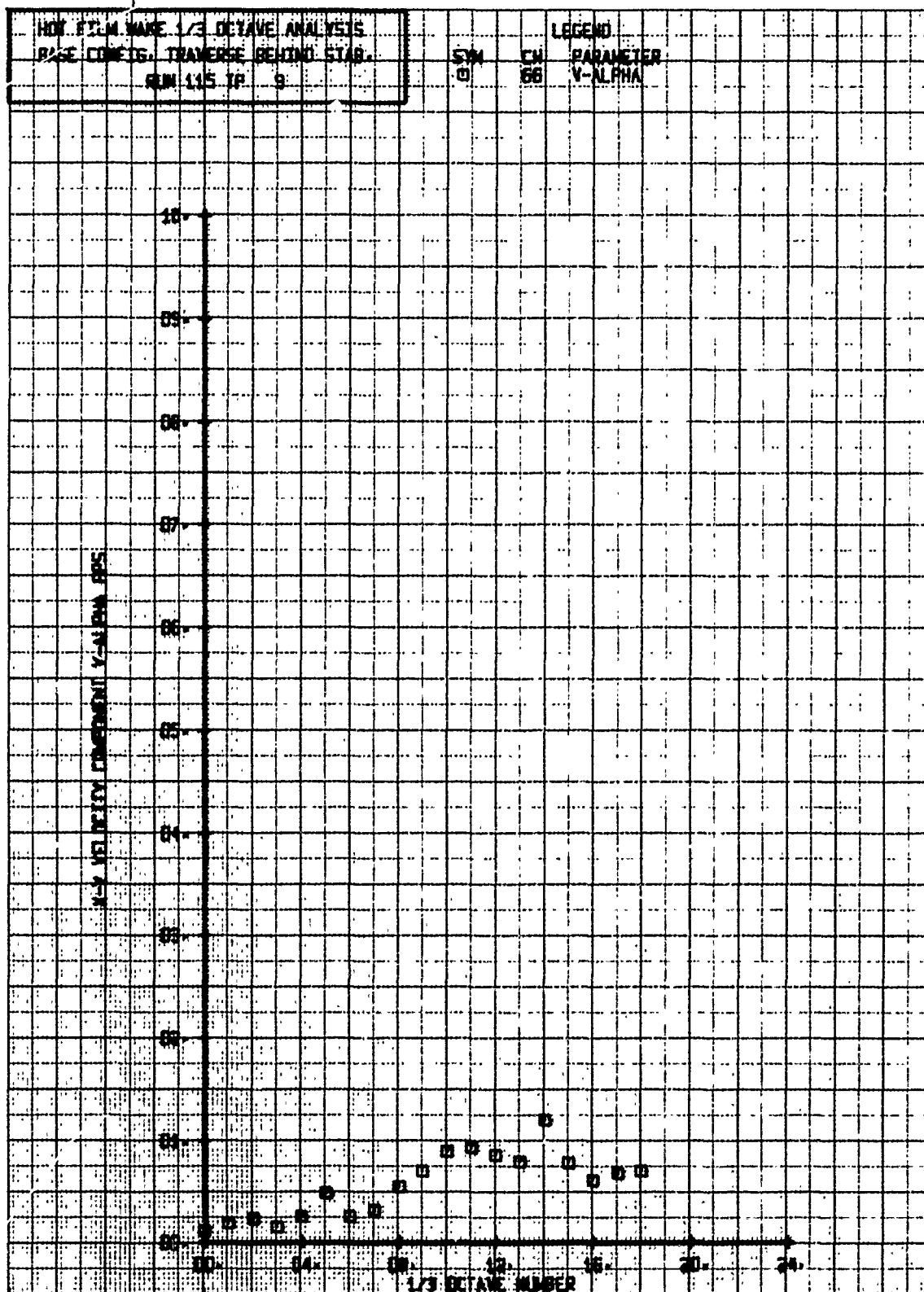


101 FILM WIRE 1/3 OCTAVE ANALYSIS  
 BASE CONFIG. TRAVERSE BENDING STAB.  
 RUN 115 TP

CH 56  
 PARAMETER  
 Y-ALPHA



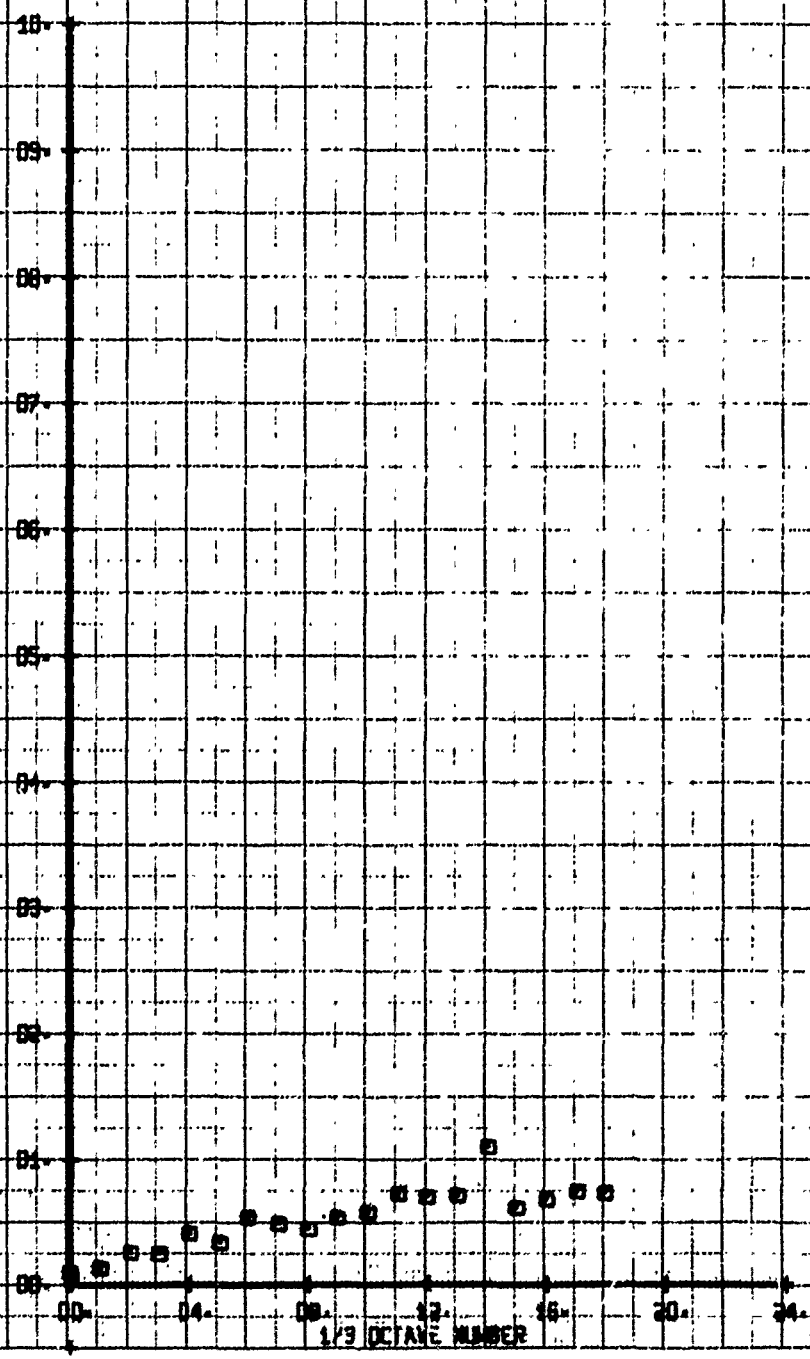




HOT FILM WAVE 1/3 OCTAVE ANALYSIS  
 BASE CORRECTED TRAVERSE BEHIND STAB  
 RUN 145 TP 10

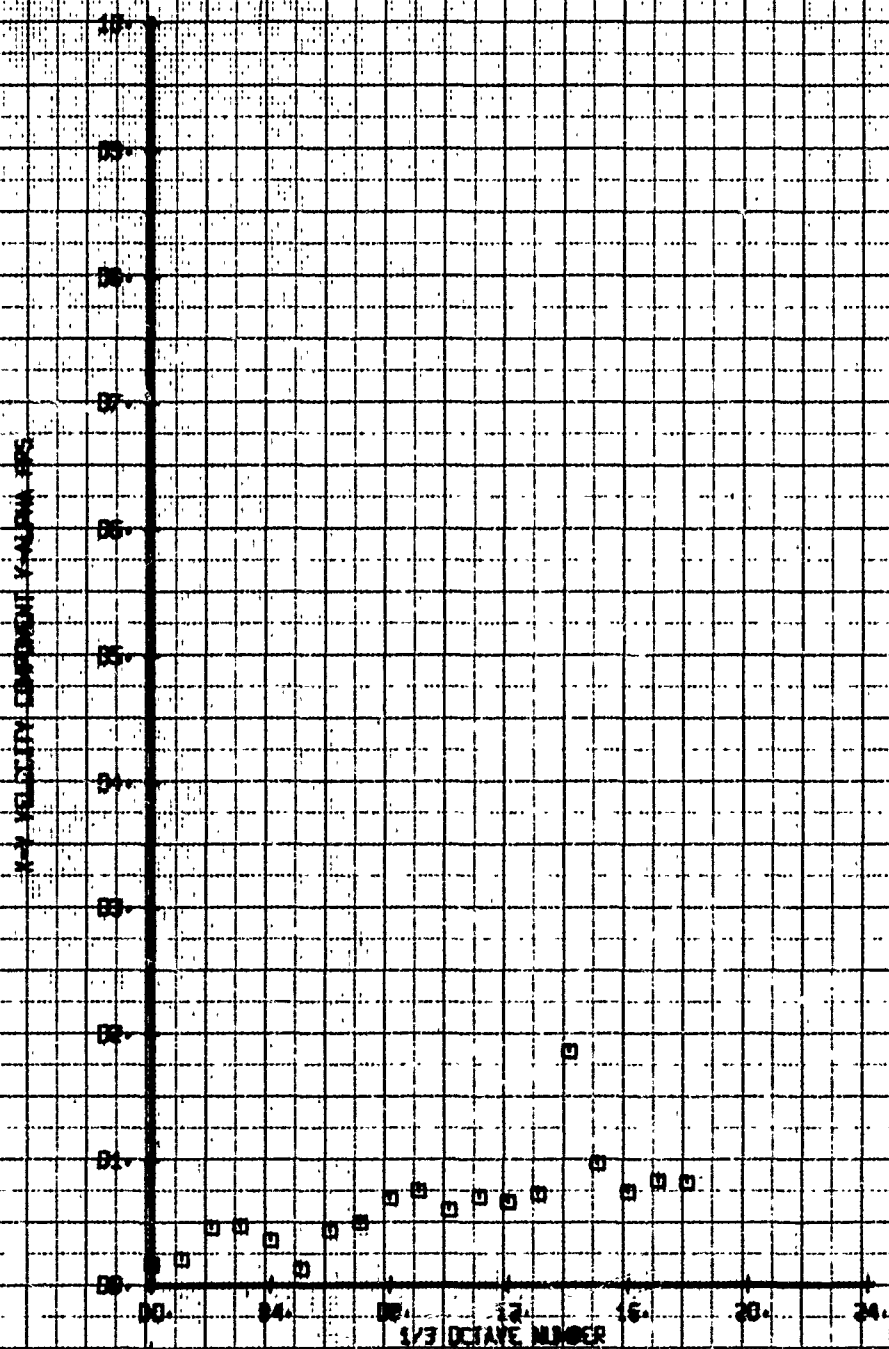
SYN CH  
 0 66  
 LEGEND  
 PARAMETER  
 V-ALPHA

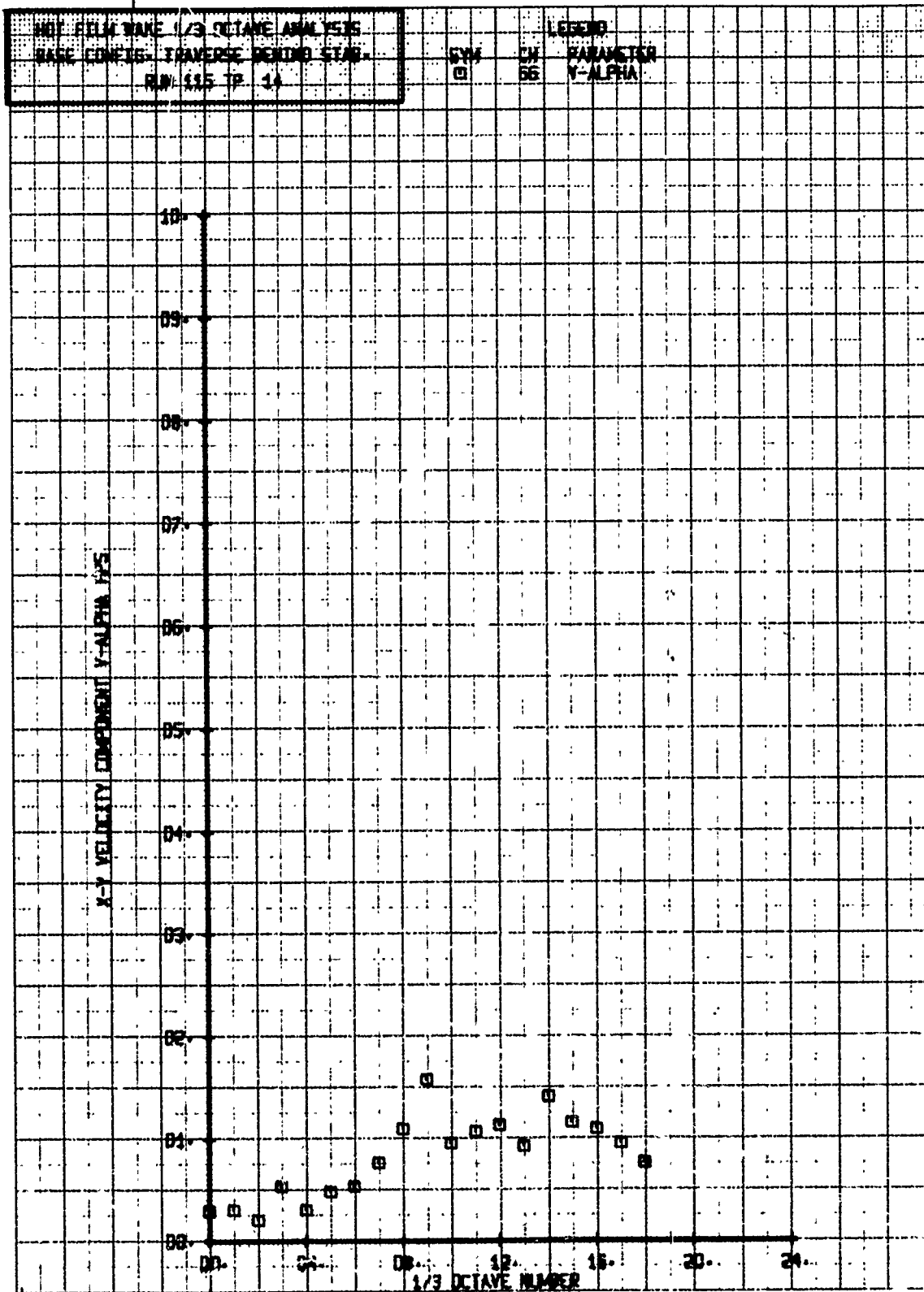
WAVE VELOCITY COMPONENT V-ALPHA FPS

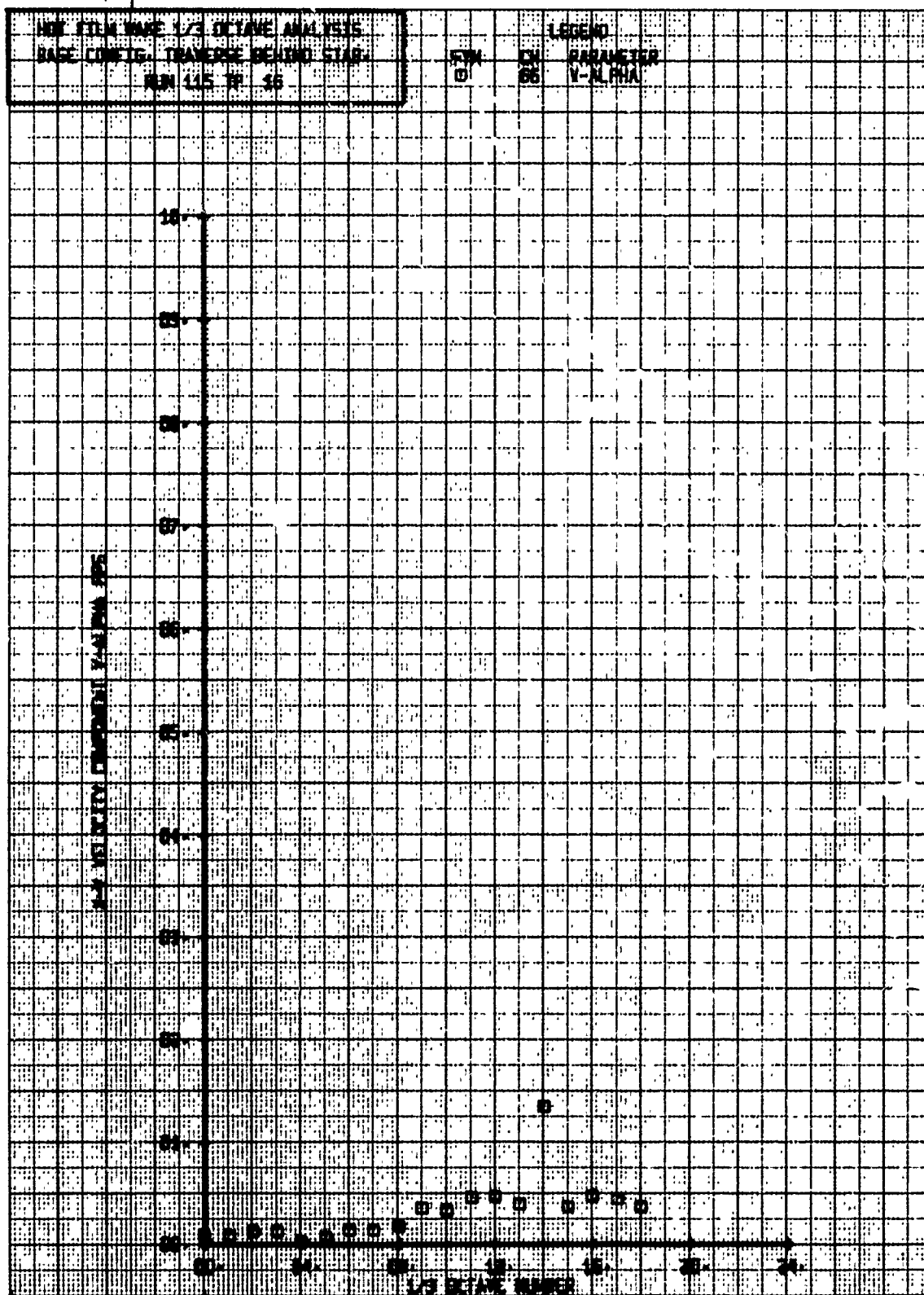


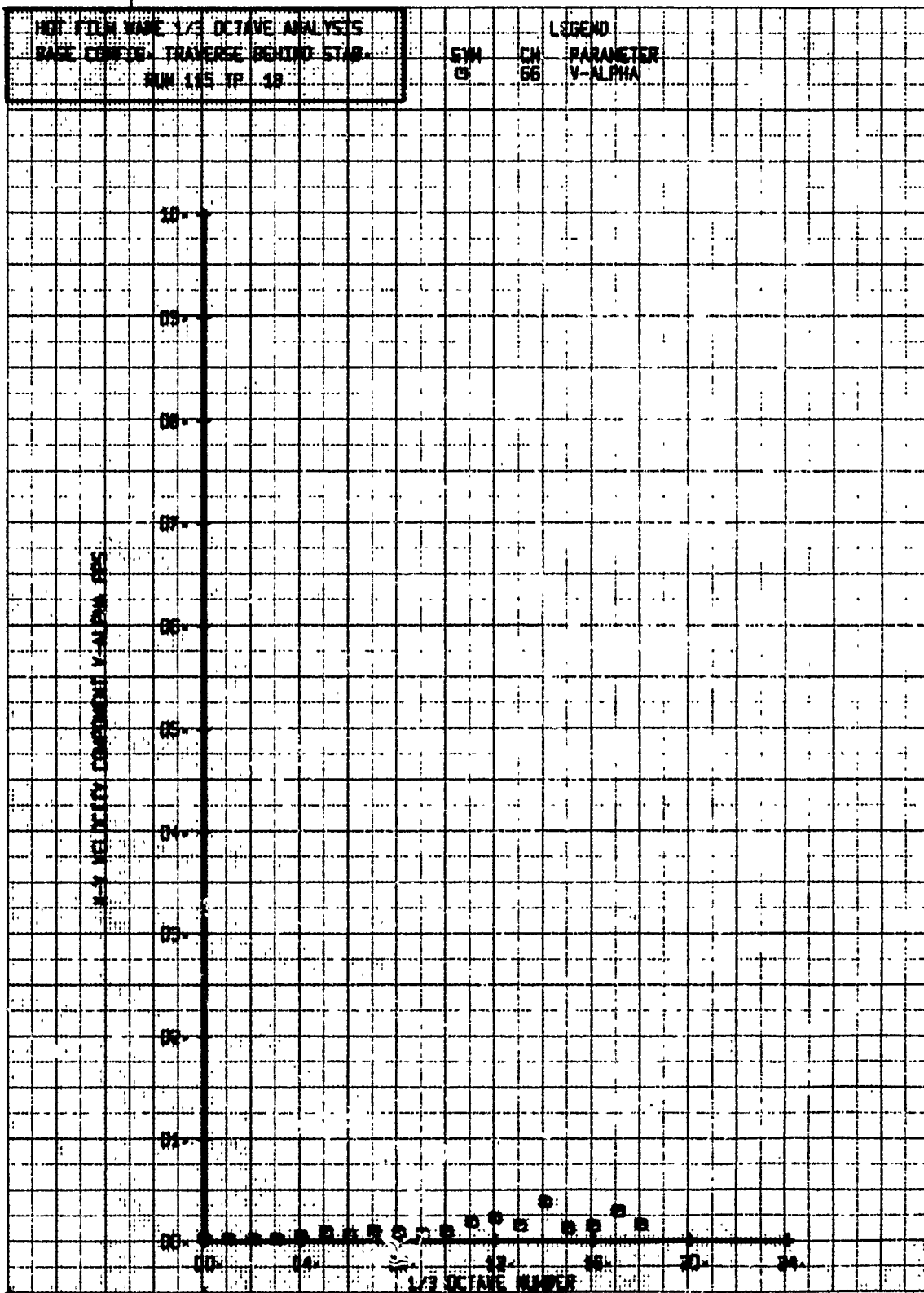


PERSON  
FARMER  
VIRGINIA



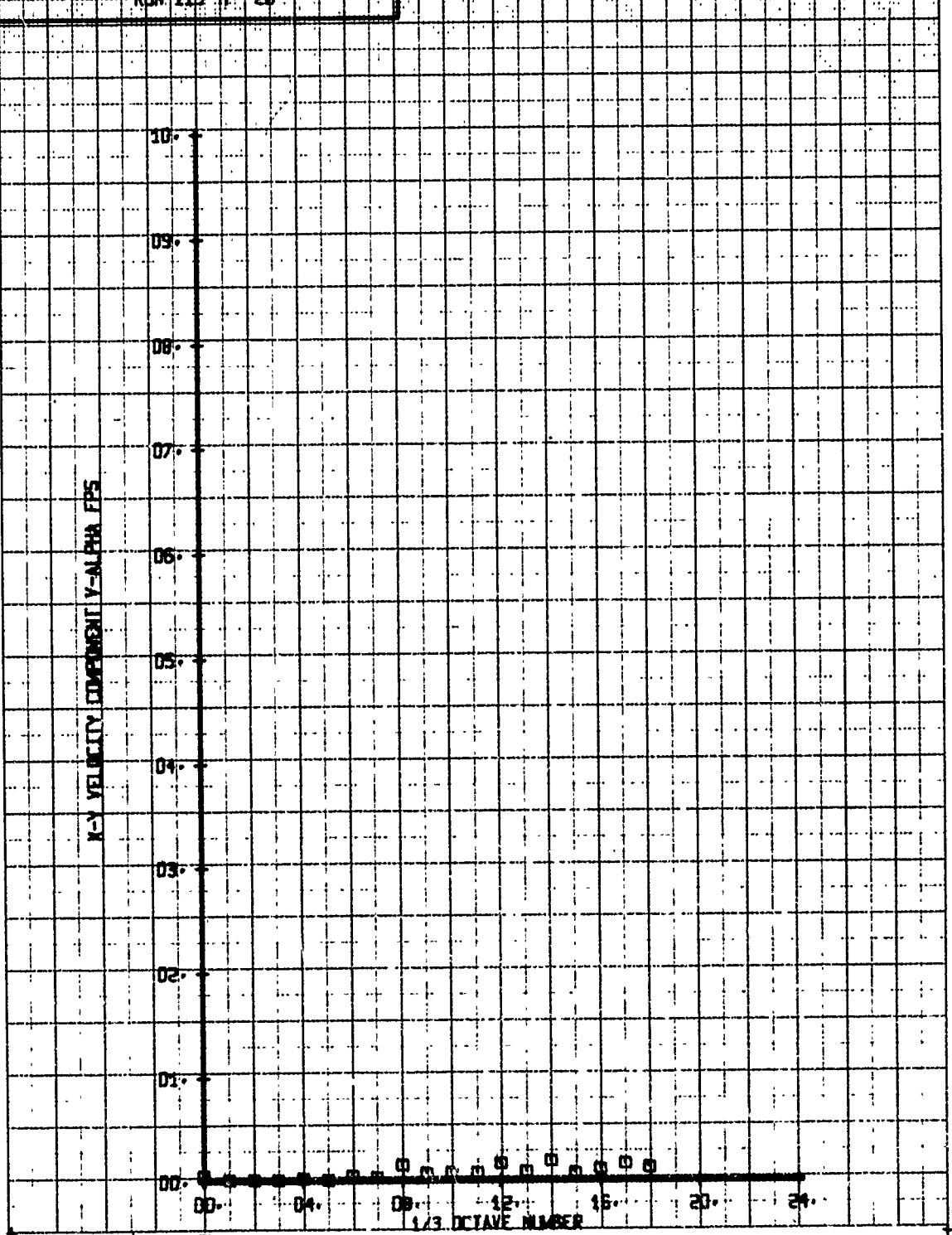


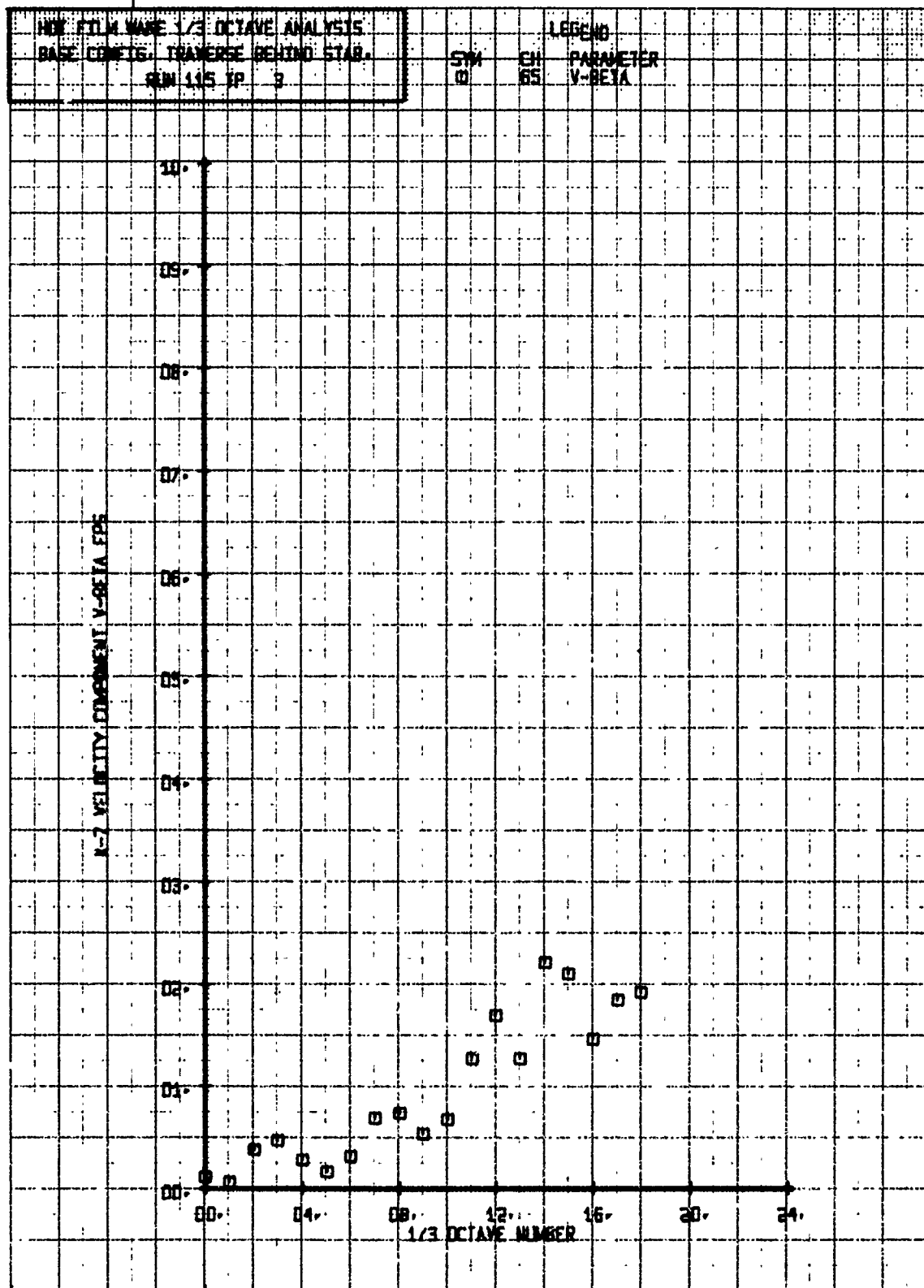


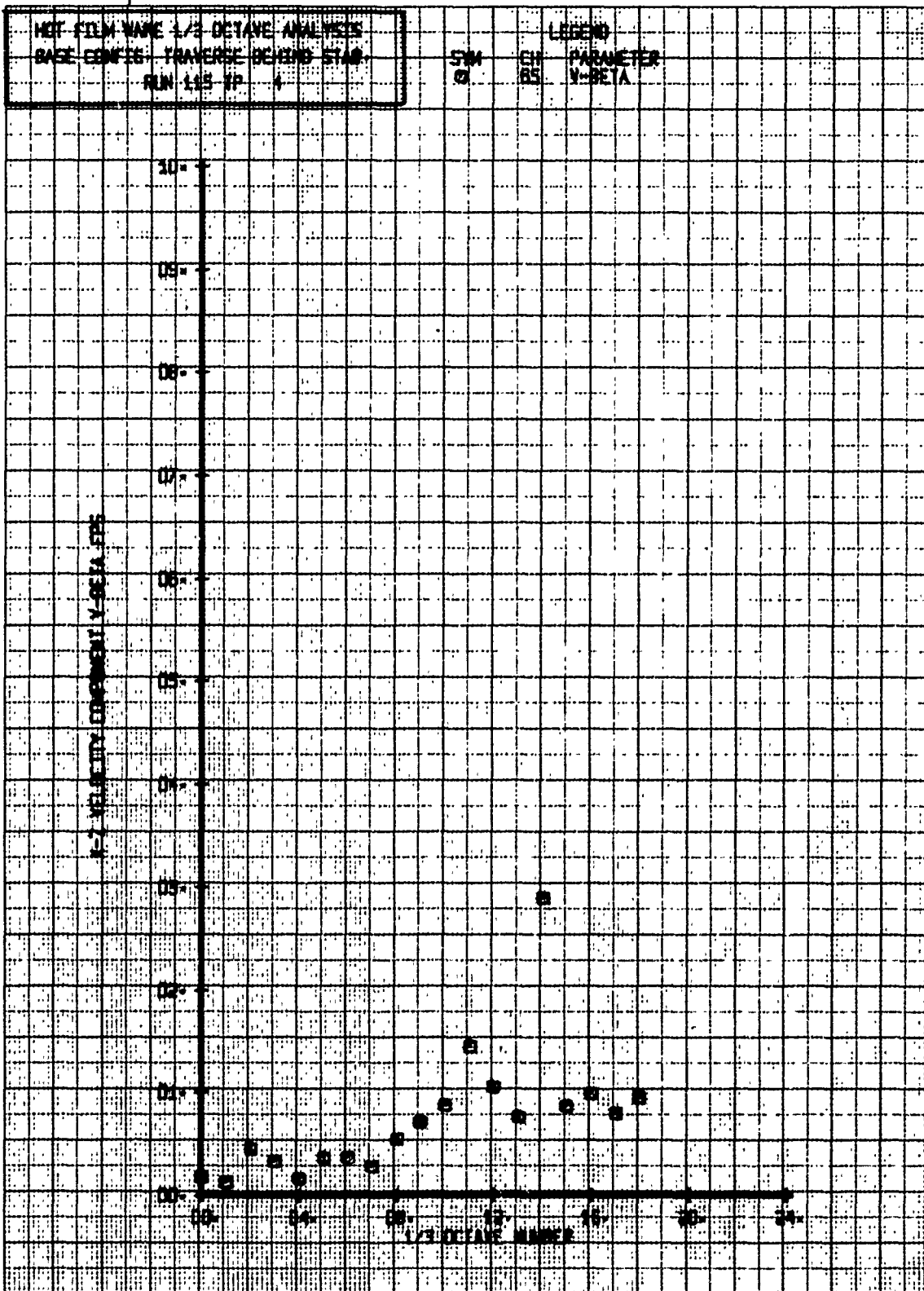


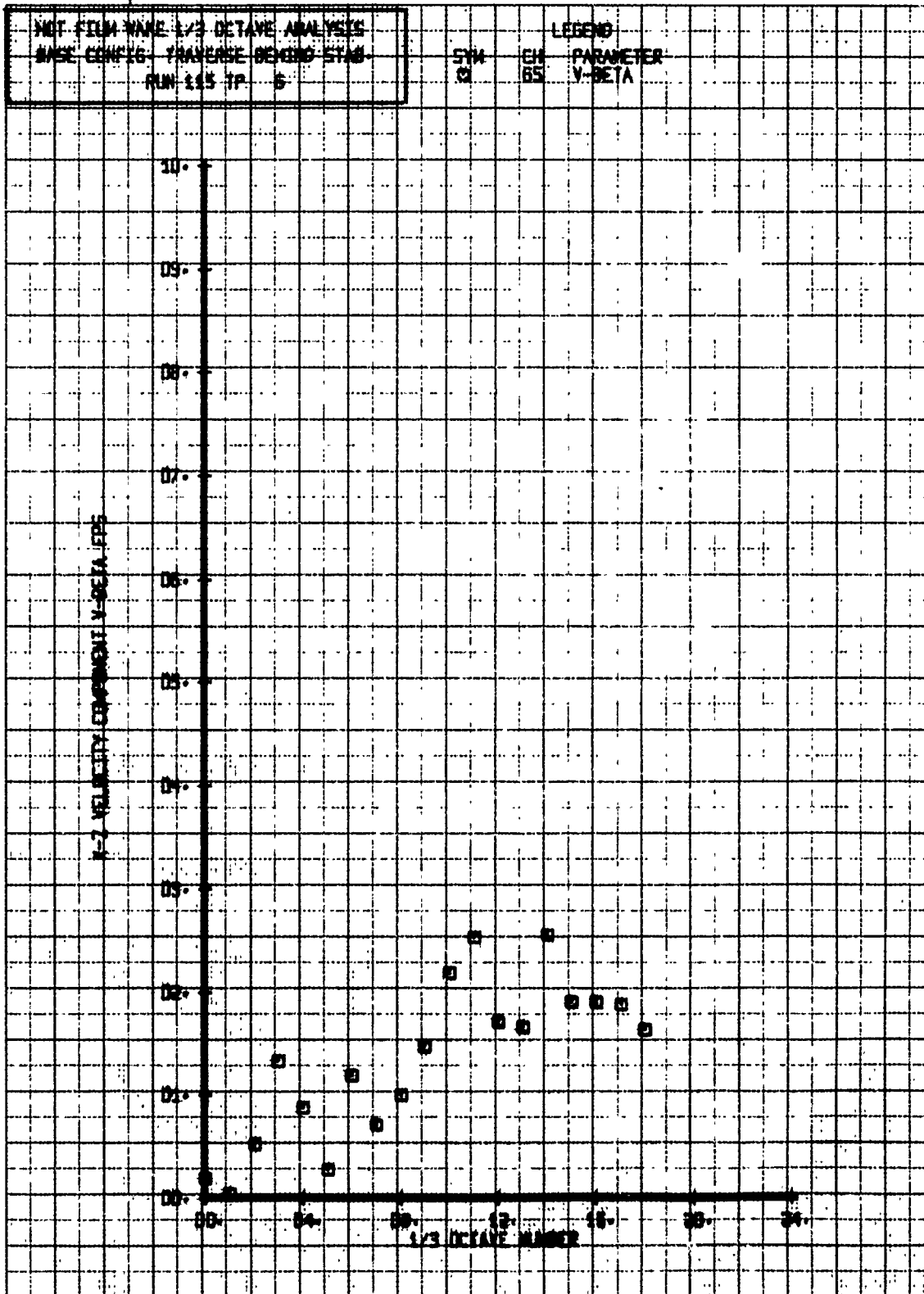
NOY FILE NAME 1/3 OCTAVE ANALYSIS  
 BASE CONFIG TRAVERSE BEARING STAG  
 RUN 115 TP 20

SYN 01 EN 56  
 PARAMETER  
 Y-ALPHA

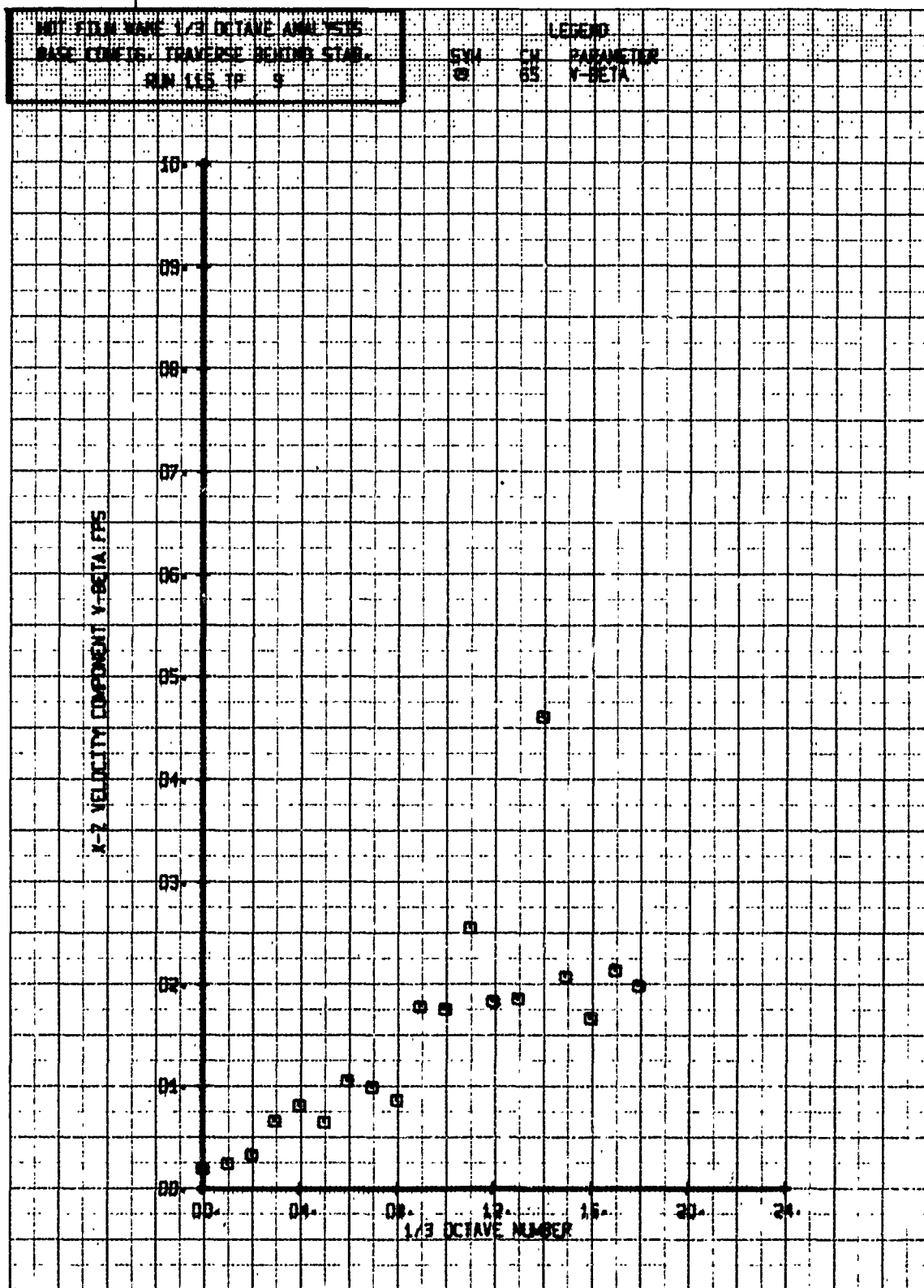












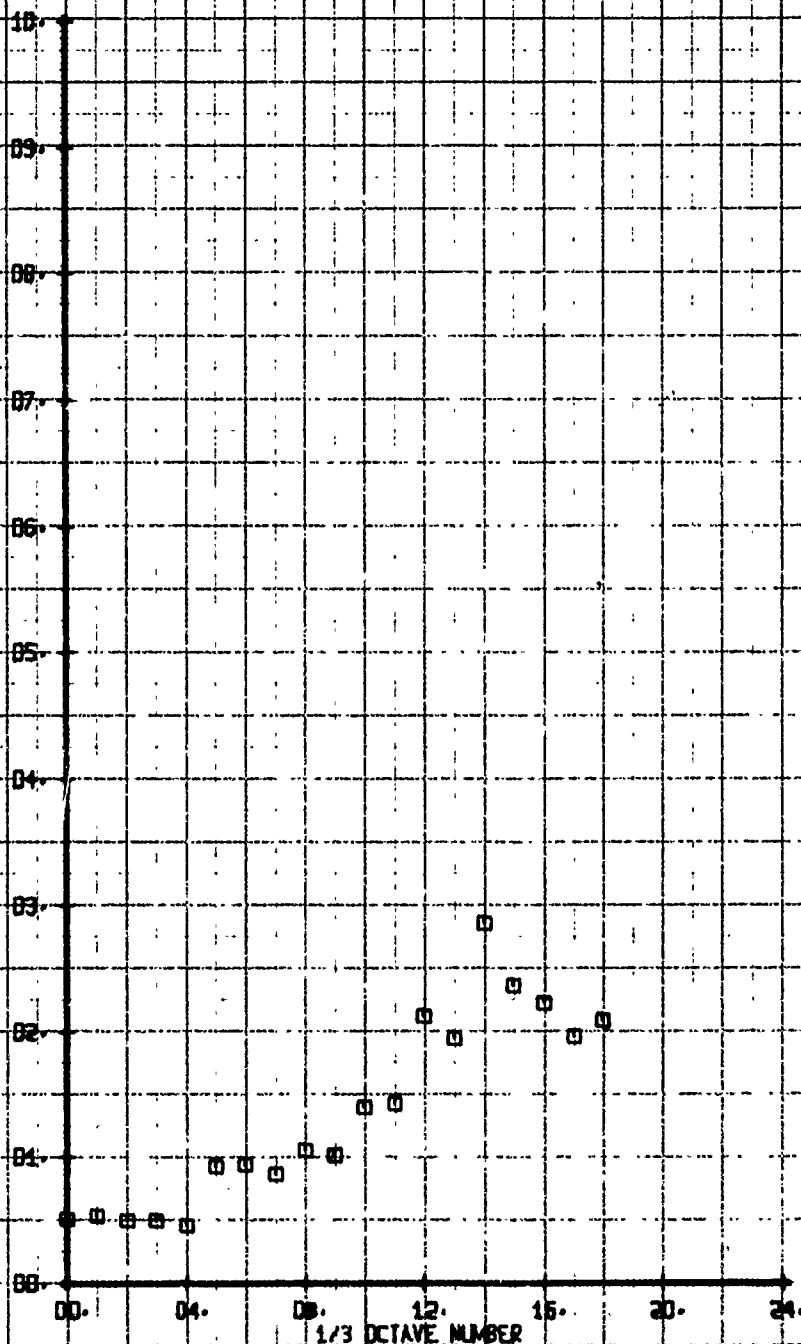
NO. 114 WAKE 1/3 OCTAVE ANALYSIS  
 BASE CONFIG. TRAVERSE BENDING STAB.  
 RUN 115 TP 10

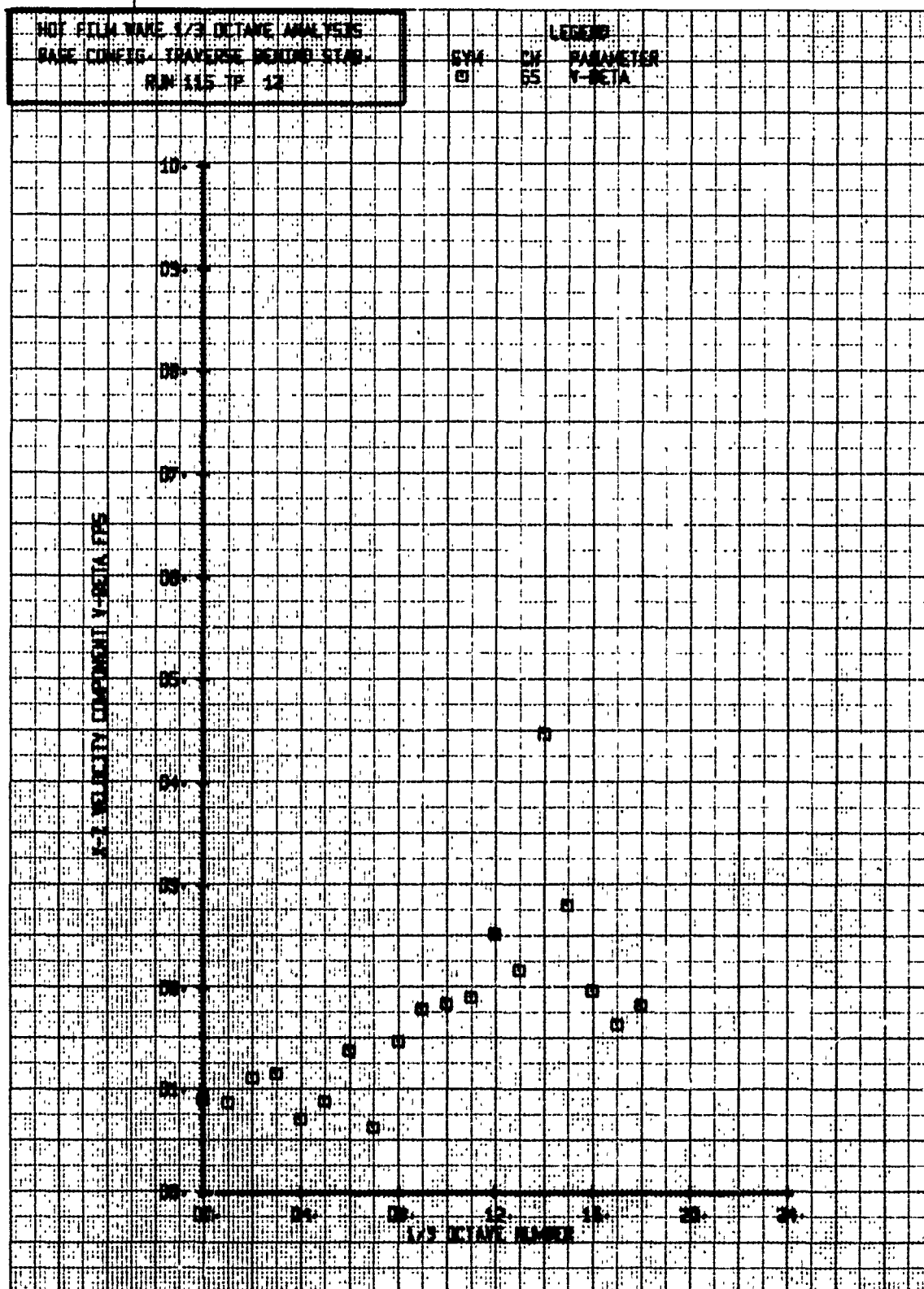
SYN  
 □

CH  
 65

LEGEND  
 PARAMETER  
 Y-BETA

X-Z VELOCITY COMPONENT Y-BETA FFS

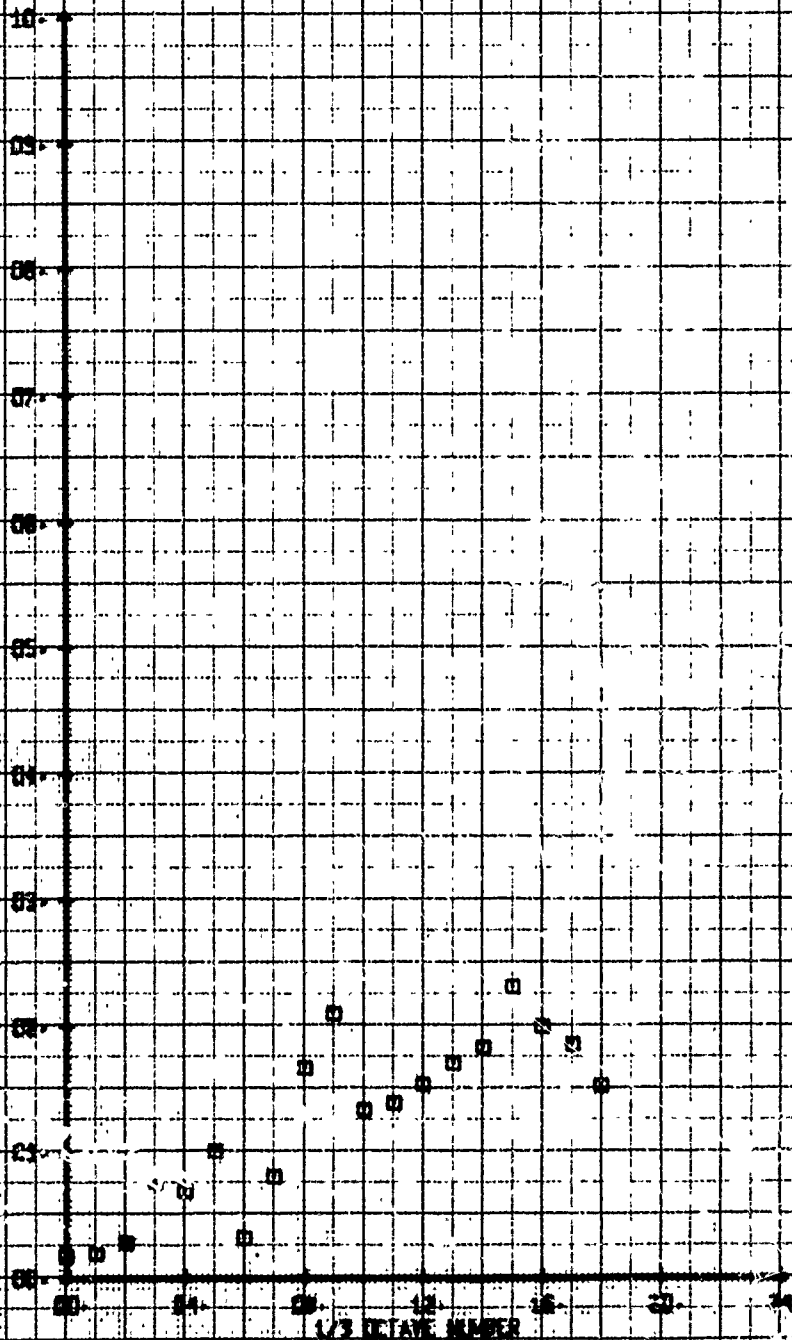


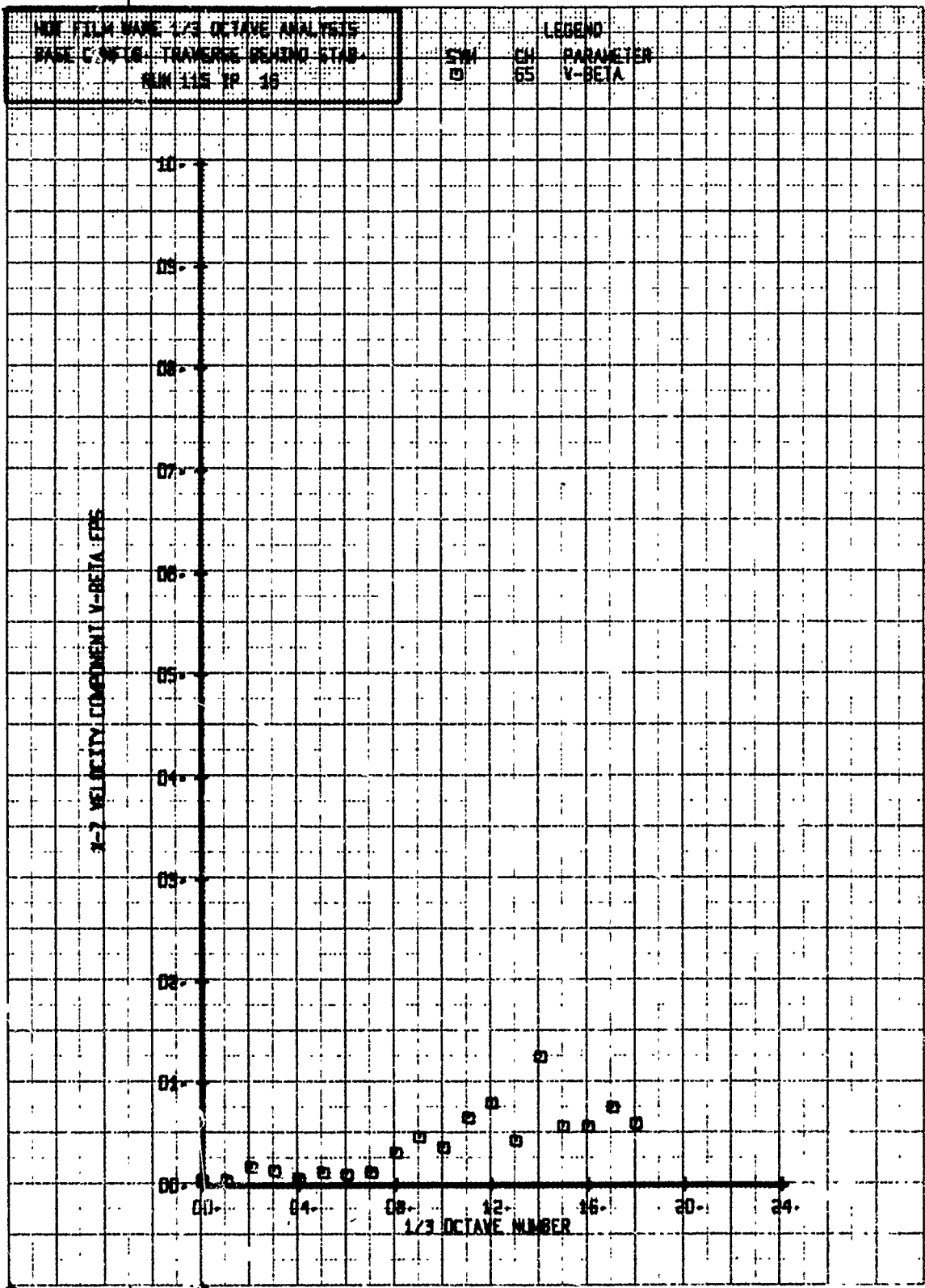


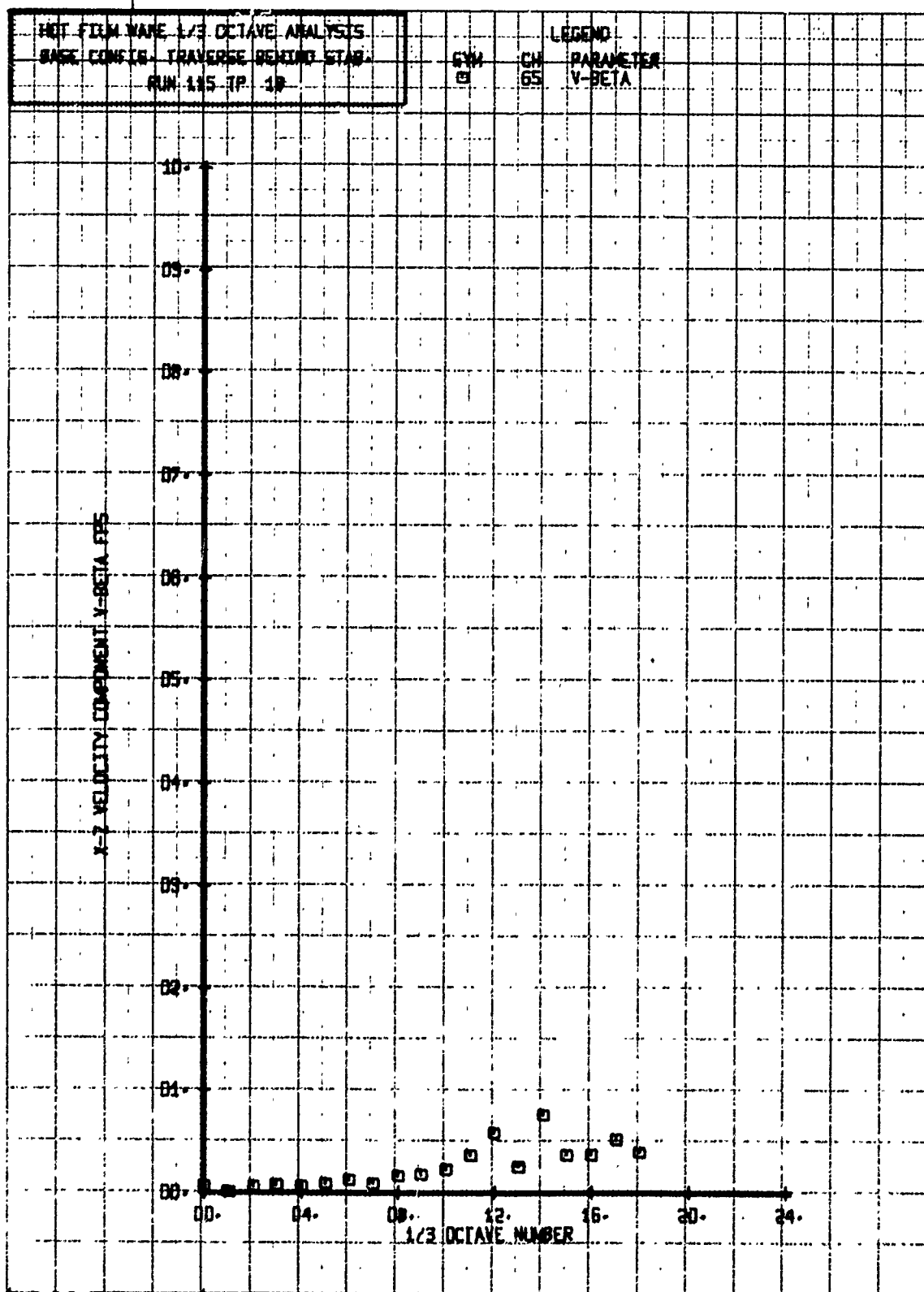
HOW FILM WARE 1/3 OCTAVE ANALYSIS  
 BASE CONFS: TRAVERSE DESIGN STAR  
 RUN 115 TP 14

LEGEND  
 SYM CM PARAMETER  
 BS V-BETA

1/3 RELATIVE COMPONENT V-BETA PER



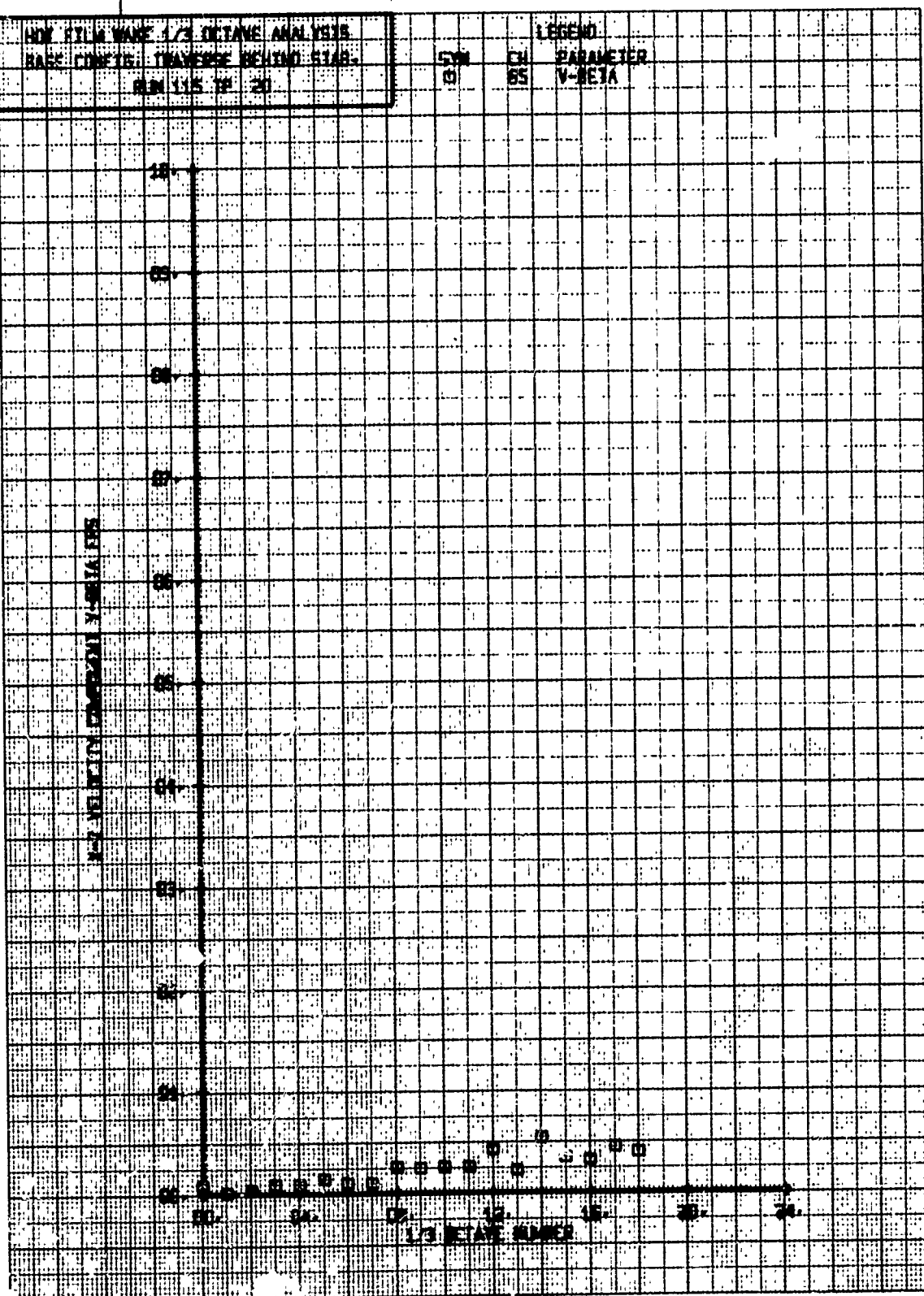




HOW FILM WARE 1/3 DETAIL ANALYSIS  
 BASE CORRECTION TRAVERSE DETAIL STAB.  
 RUN 115 12 20

LEGEND  
 CH PARAMETER  
 65 V-BETA

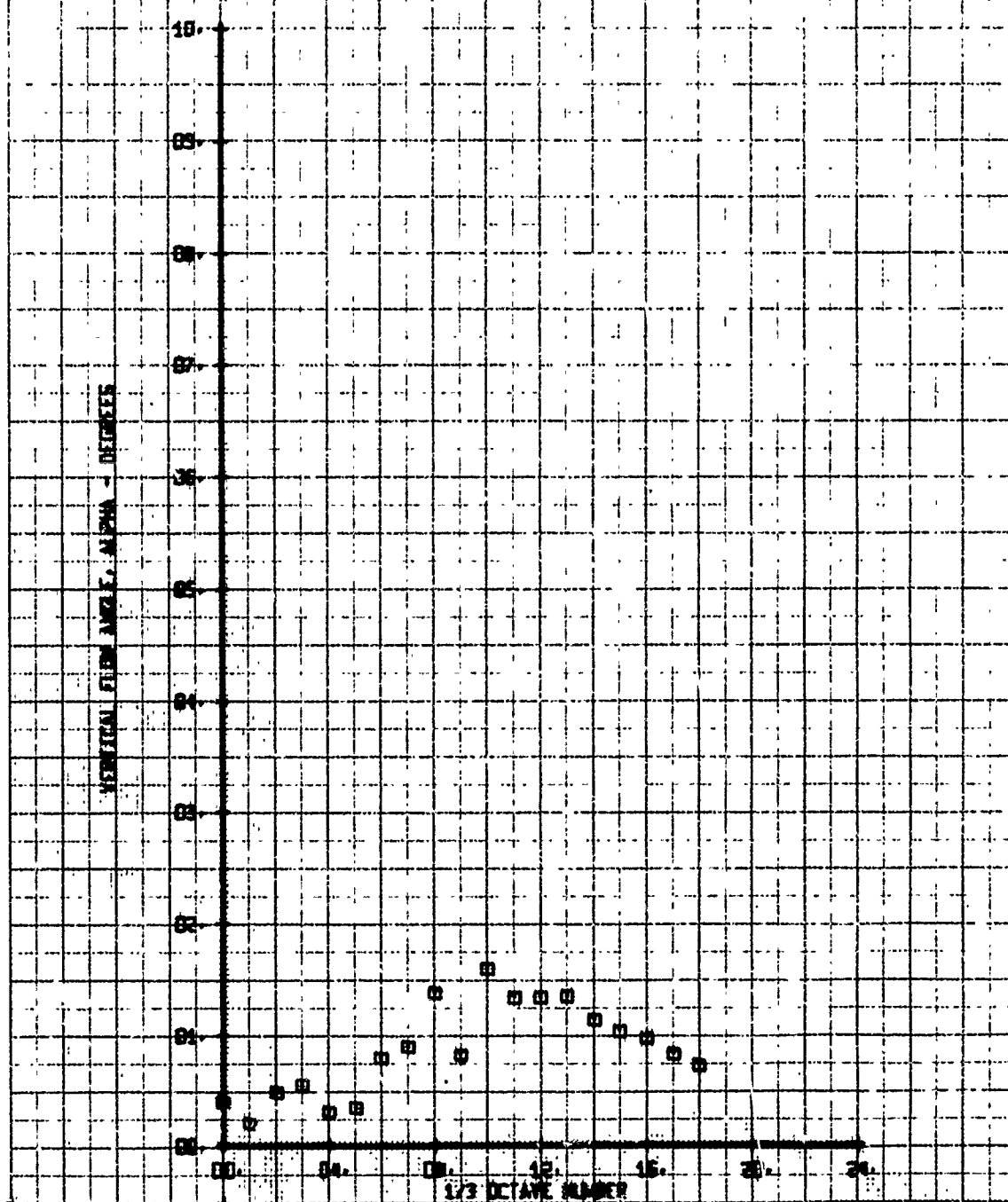
TRAVERSE DETAIL STAB.  
 1/3 DETAIL ANALYSIS



HOT FILM WAVE 1/3 OCTAVE ANALYSIS  
 BASE CONEIG. TRAVERSE LEFT OF STAB.  
 RUN 115 TP 7

SYM CH PARAMETER  
 □ 65 ALPHA

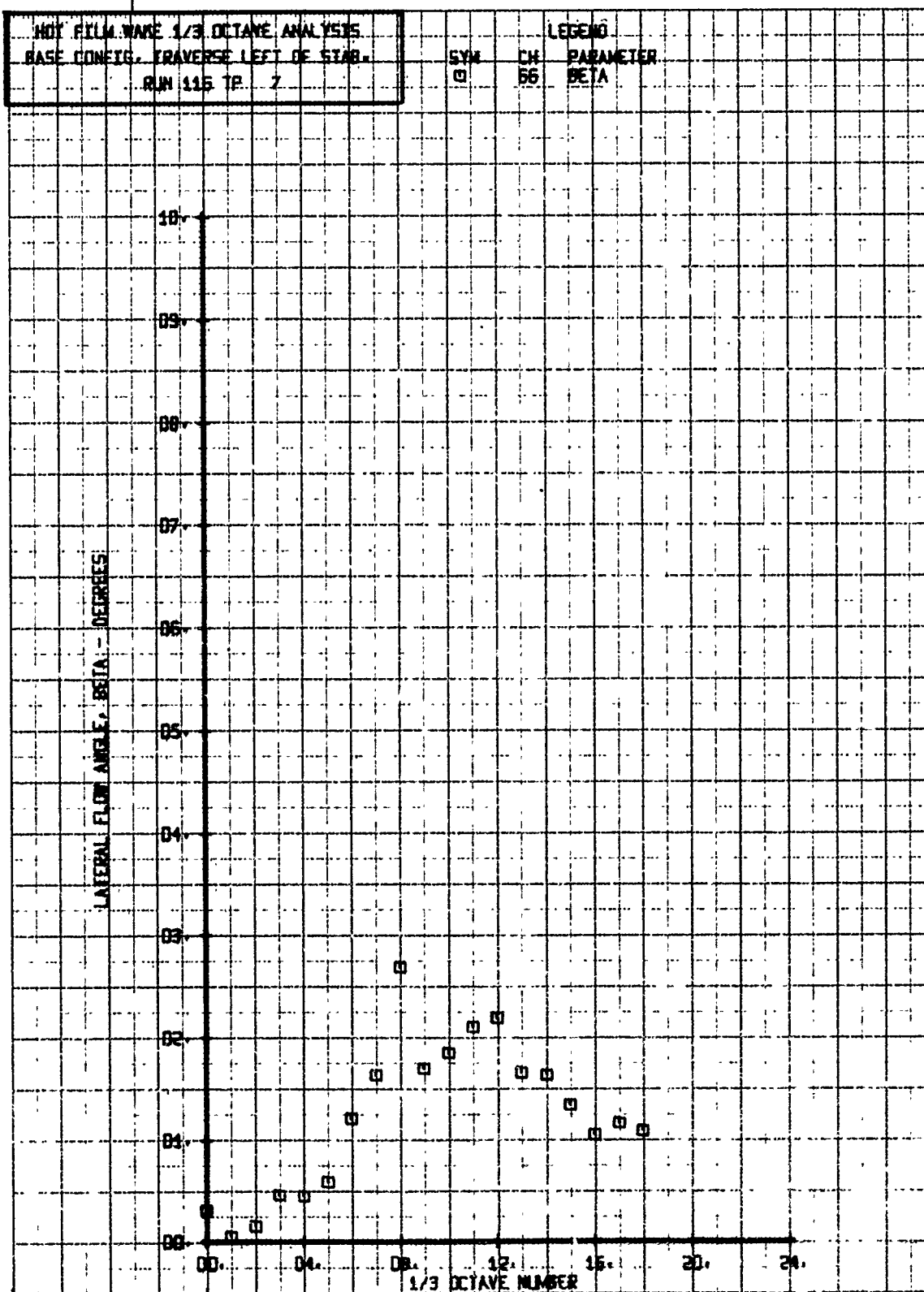
VERTICAL FLOW ANGLE, ALPHA - DEGREES

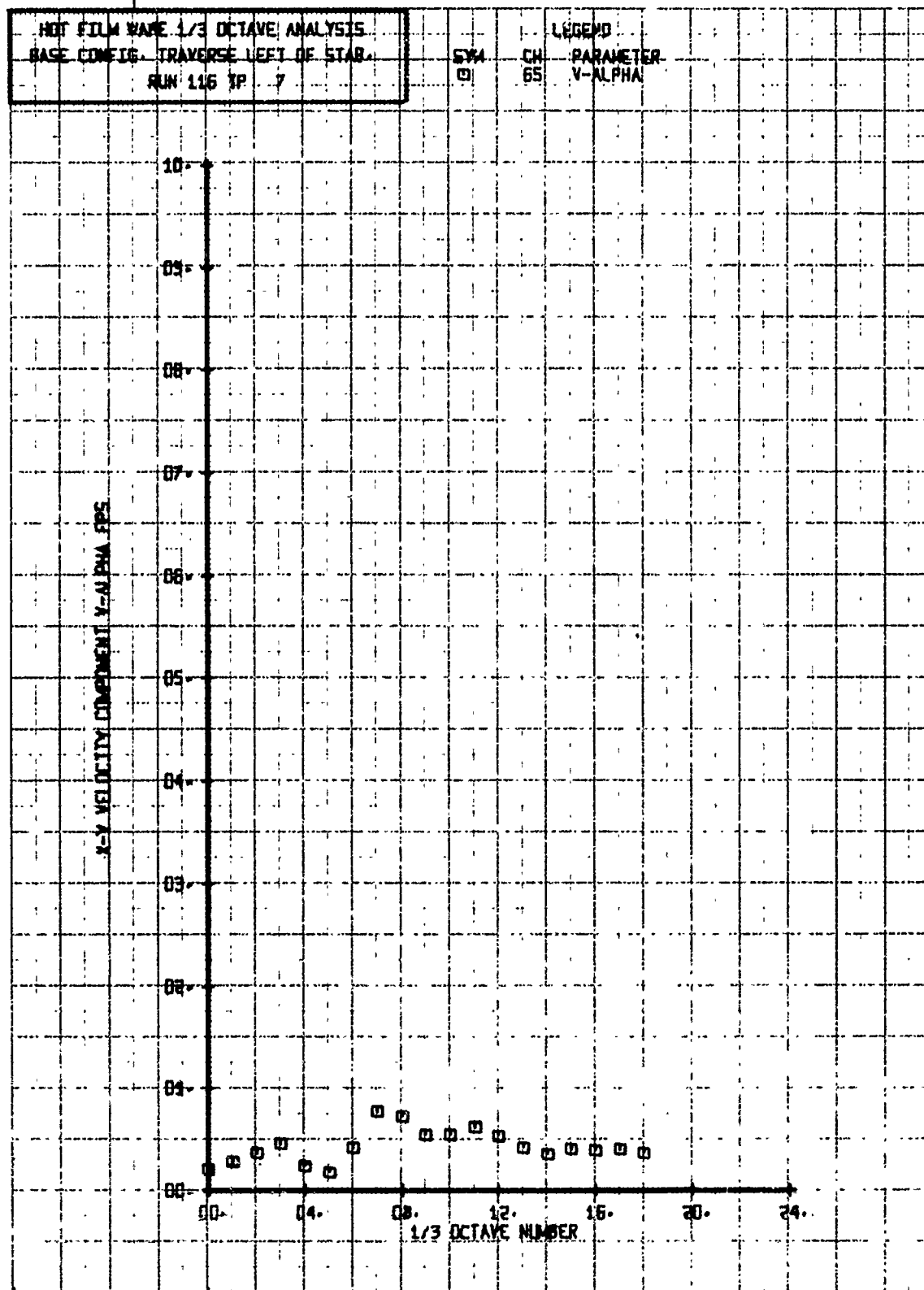


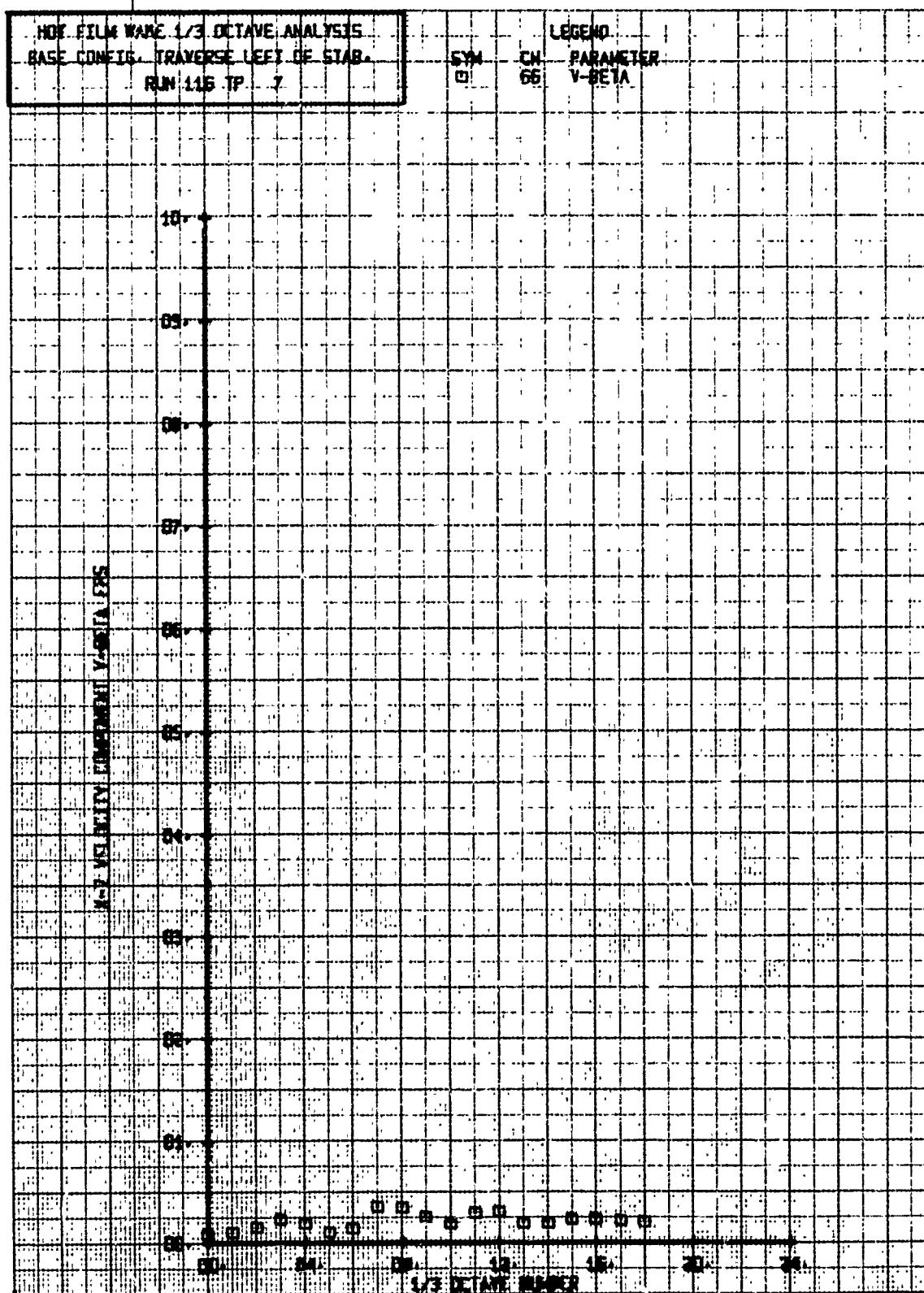


HOT FILM WAKE 1/3 OCTAVE ANALYSIS  
 BASE CONFIG. TRAVERSE LEFT OF STAR.  
 RUN 115 TP. 2

| SYM | CH | PARAMETER |
|-----|----|-----------|
| □   | 56 | BETA      |

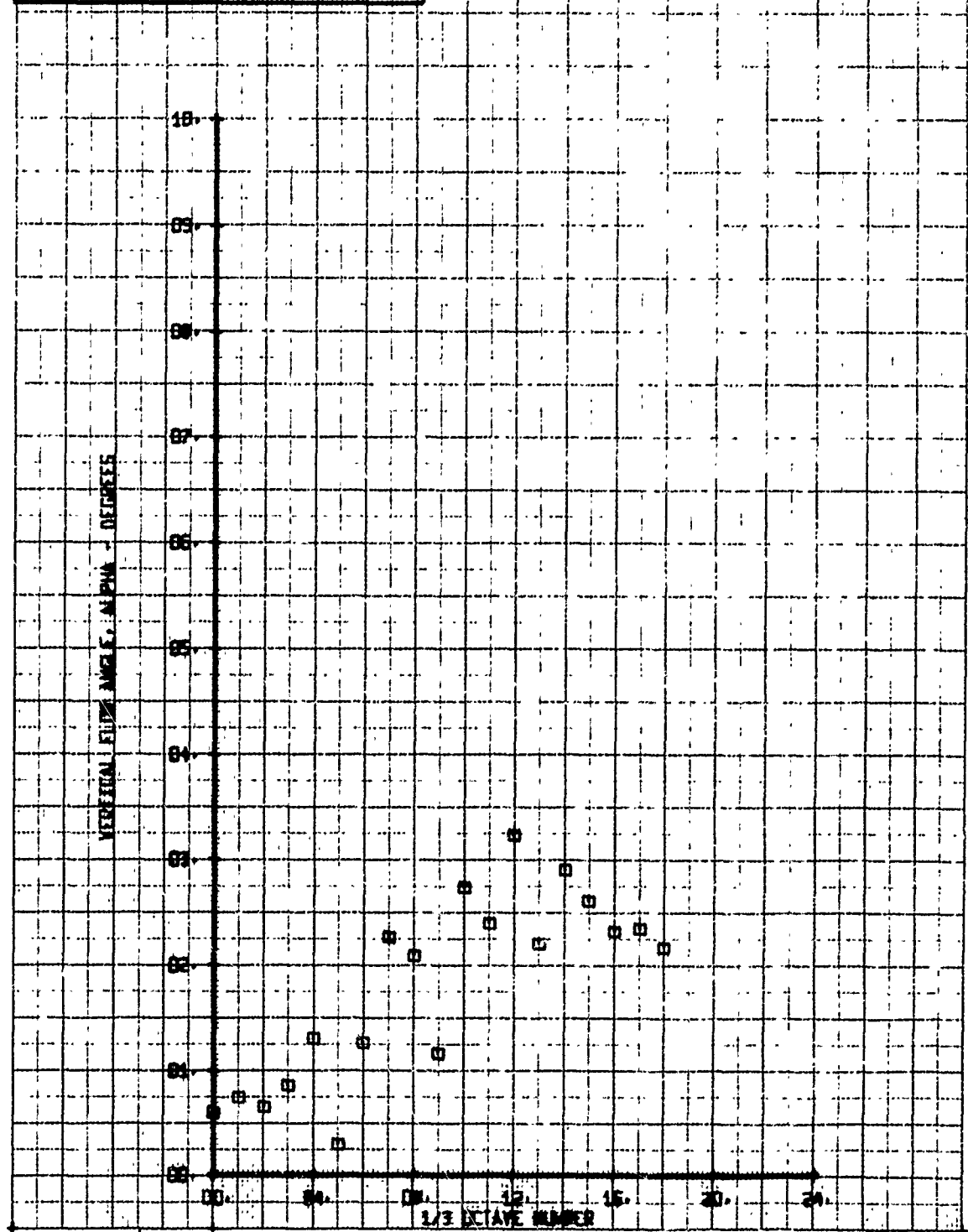


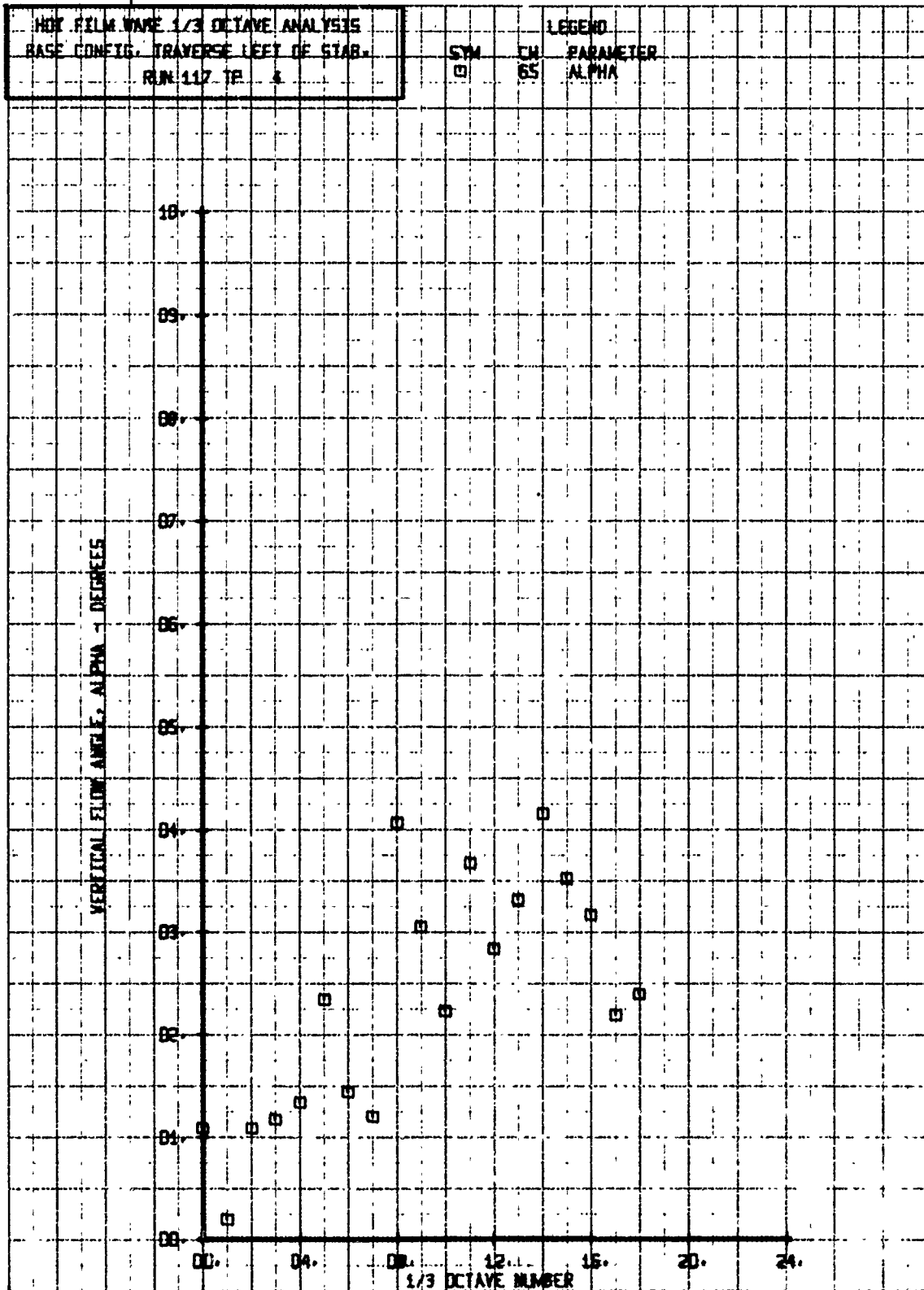




HOT FILM WAVE 1/3 OCTAVE ANALYSIS  
 BASE CONFIG. TRAVERSE LEFT OF STAB.  
 RUN 117 TP 2

SYM CH  
 0 65  
 LEGEND  
 PARAMETER  
 ALPHA

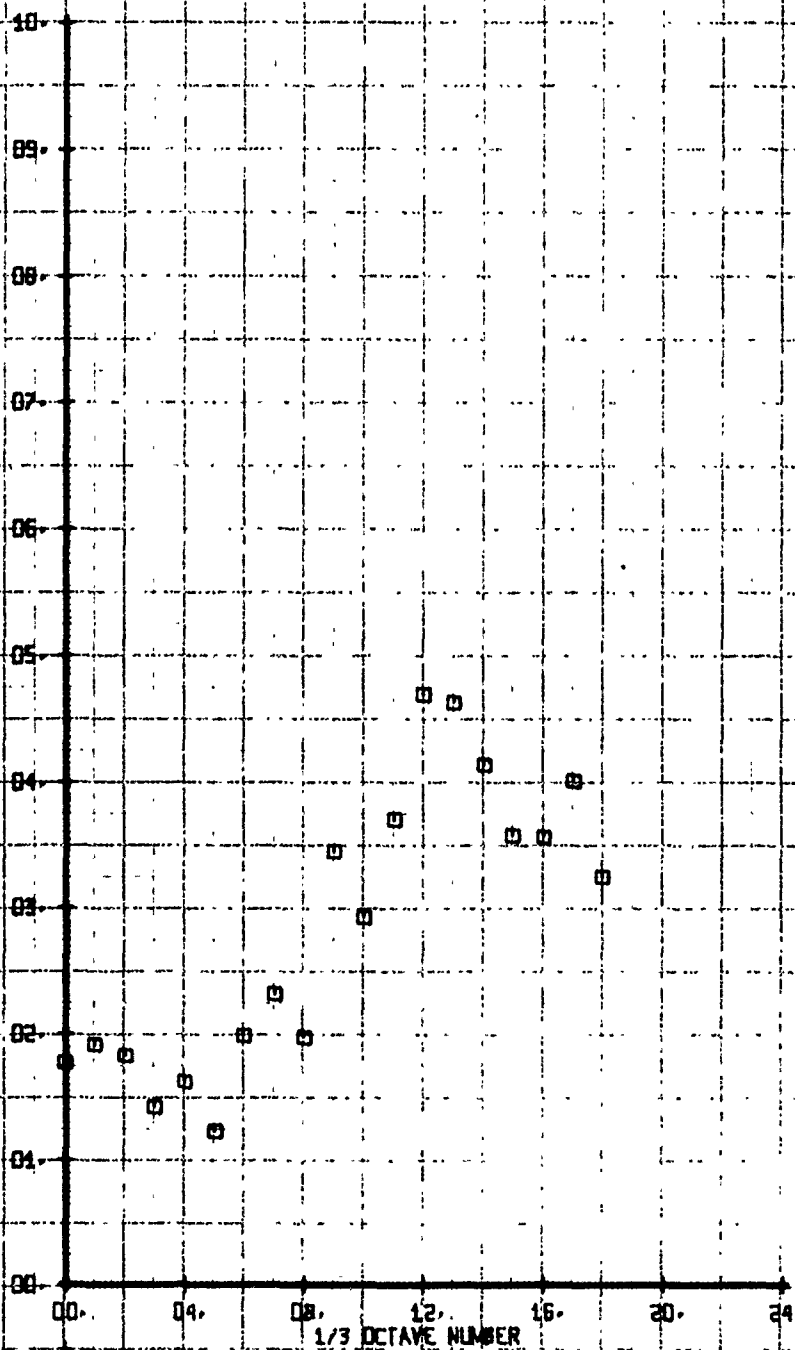




HOT FILM WAKE 1/3 OCTAVE ANALYSIS  
 BASE CONFIG. TRAVERSE LEFT OF STAR.  
 RUN 112 IP 6.

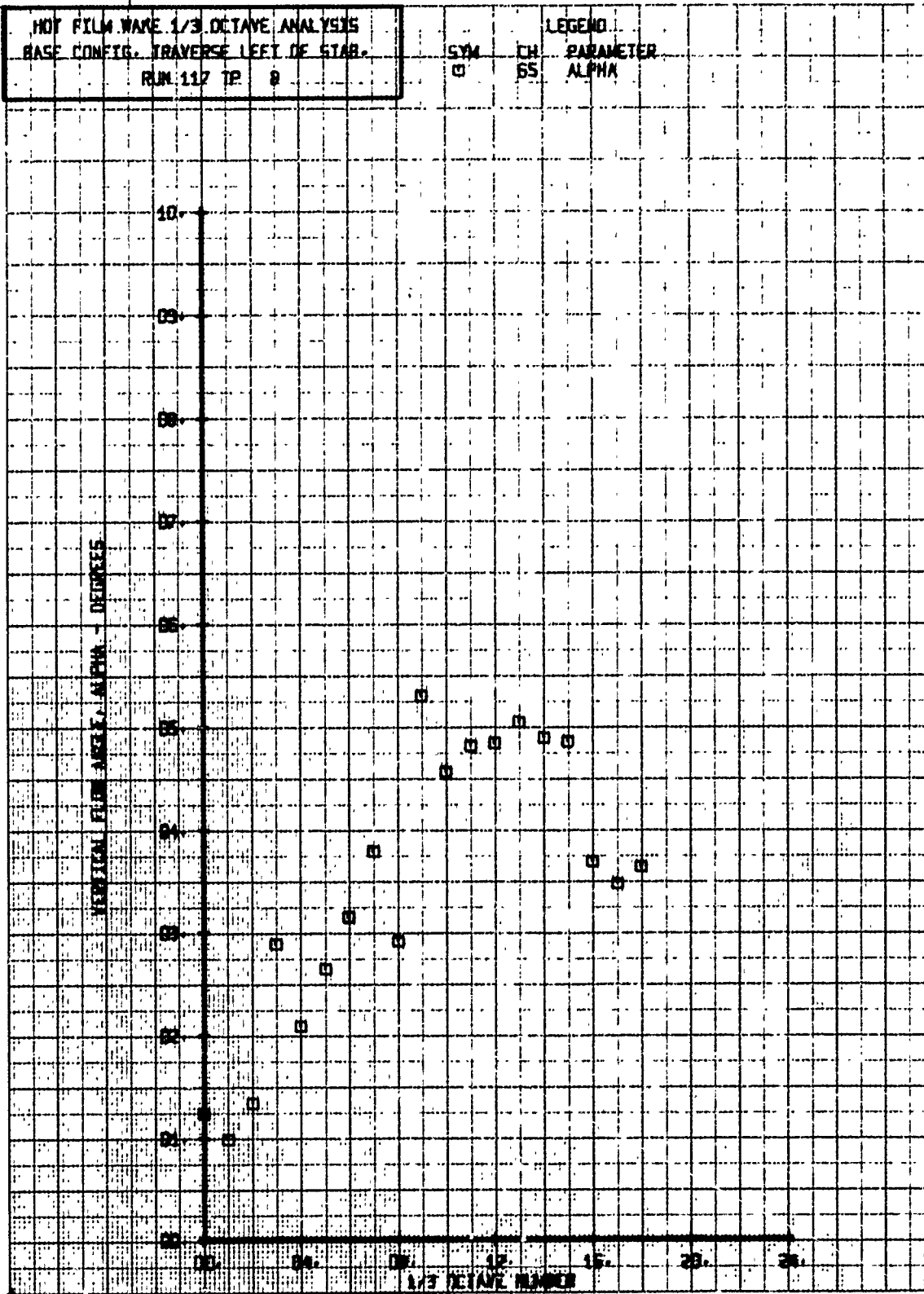
SYM CH PARAMETER  
 0 65 ALPHA

VERTICAL FLOW ANGLE, ALPHA - DEGREES



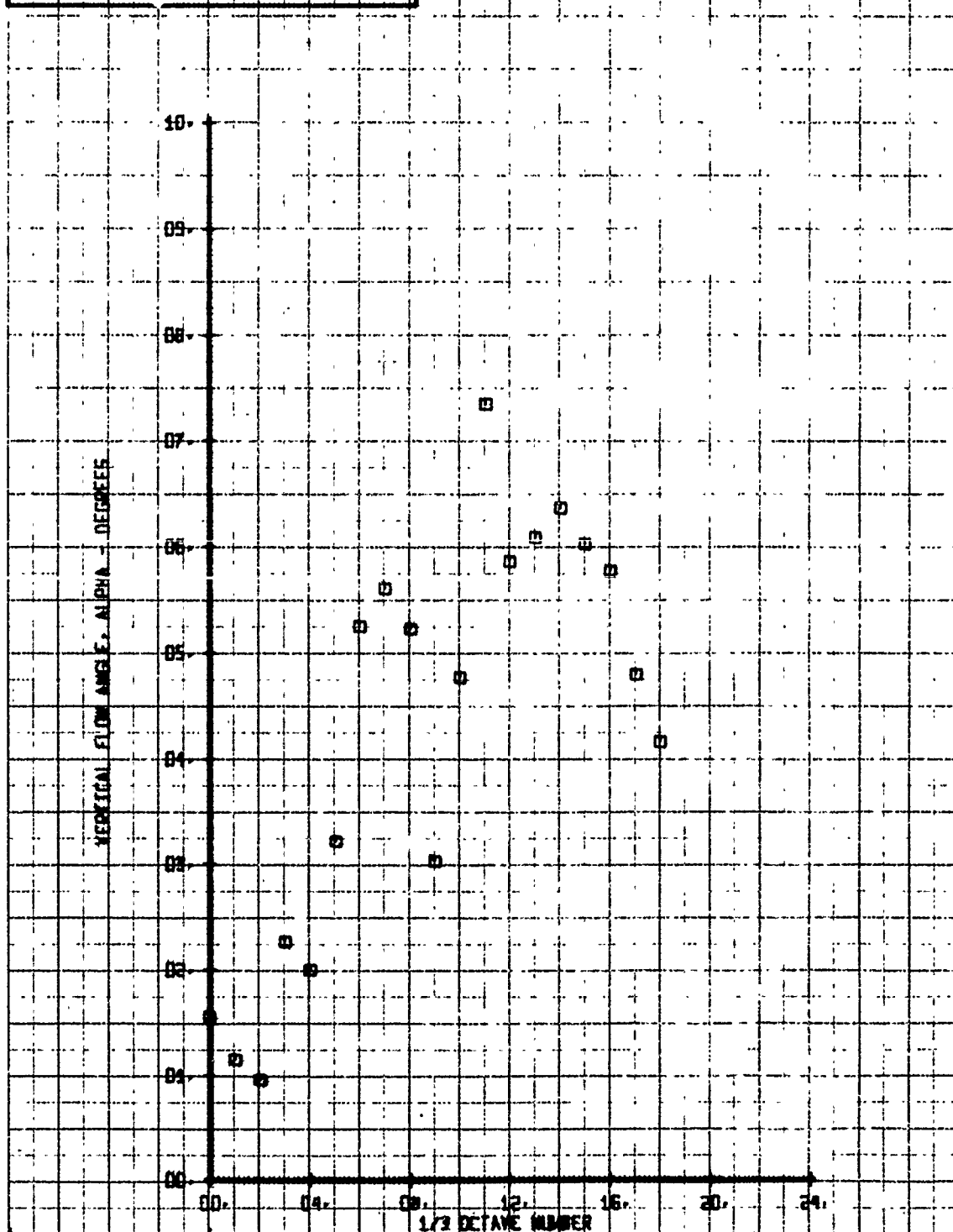
HOT FILM WAKE 1/3 OCTAVE ANALYSIS  
 BASE CONFIG. TRAVERSE LEFT OF STAR.  
 RUN 117 TP 8

SYM CH PARAMETER  
 □ 65 ALPHA

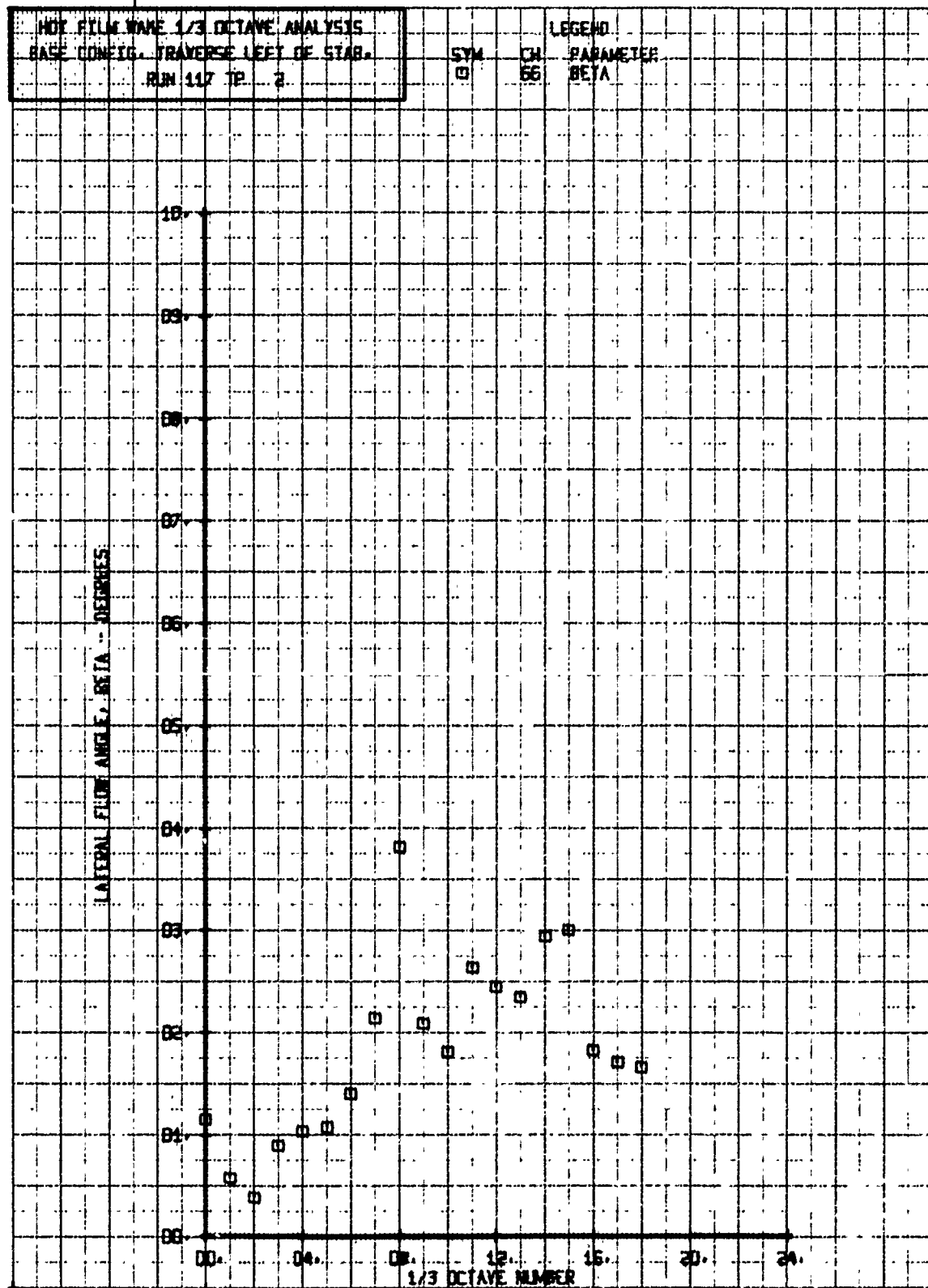


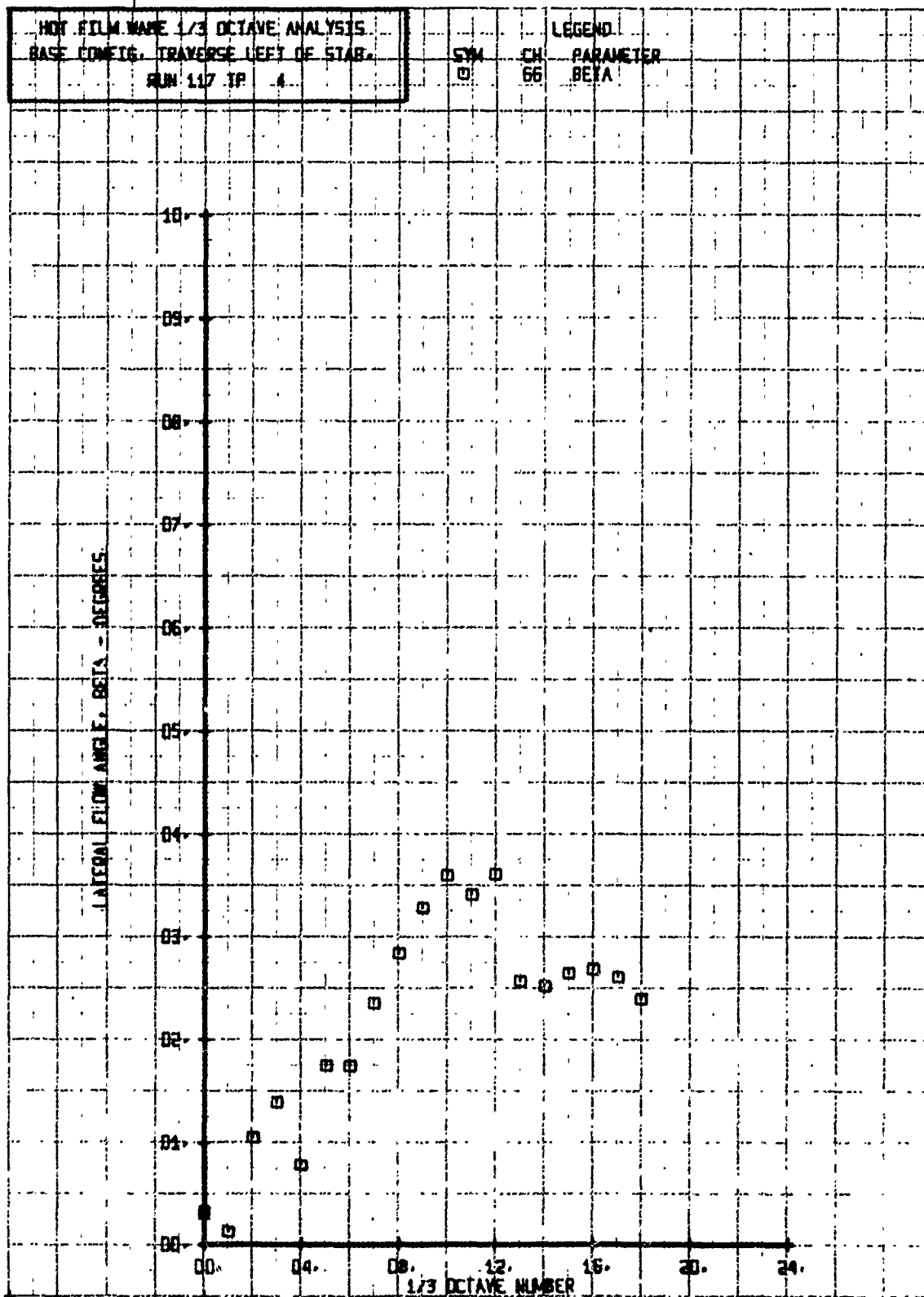
HOT FILM WAVE 1/3 OCTAVE ANALYSIS.  
 BASE CORRECTED TRAVERSE LEFT OF STAR.  
 IN 117 TP 10

SYN CH  
 0 65  
 LEGEND  
 PARAMETER  
 ALPHA





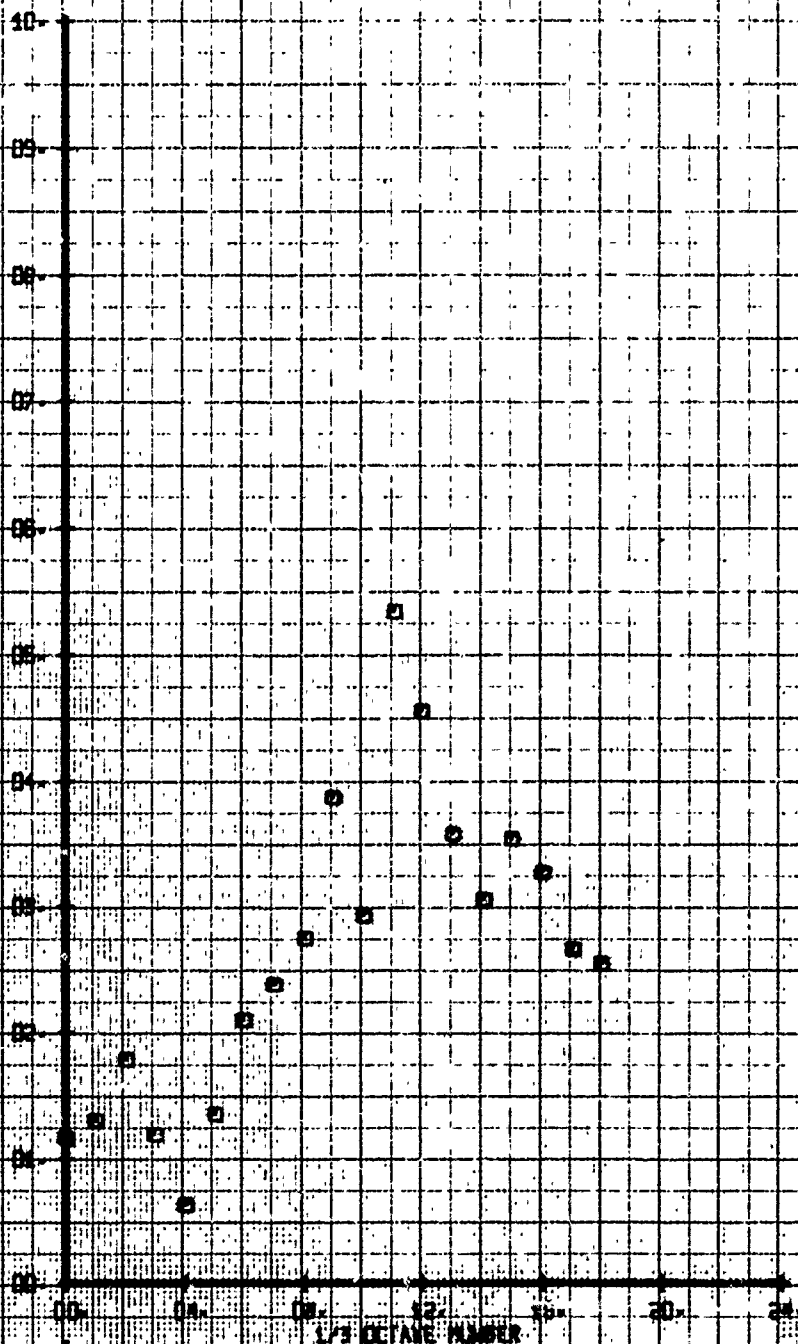




HOT FILM WAVE 1/3 OCTAVE ANALYSIS  
 BASE CORR'G. TRAVERSE LEFT OF STAR.  
 RUN 117 TP. 5

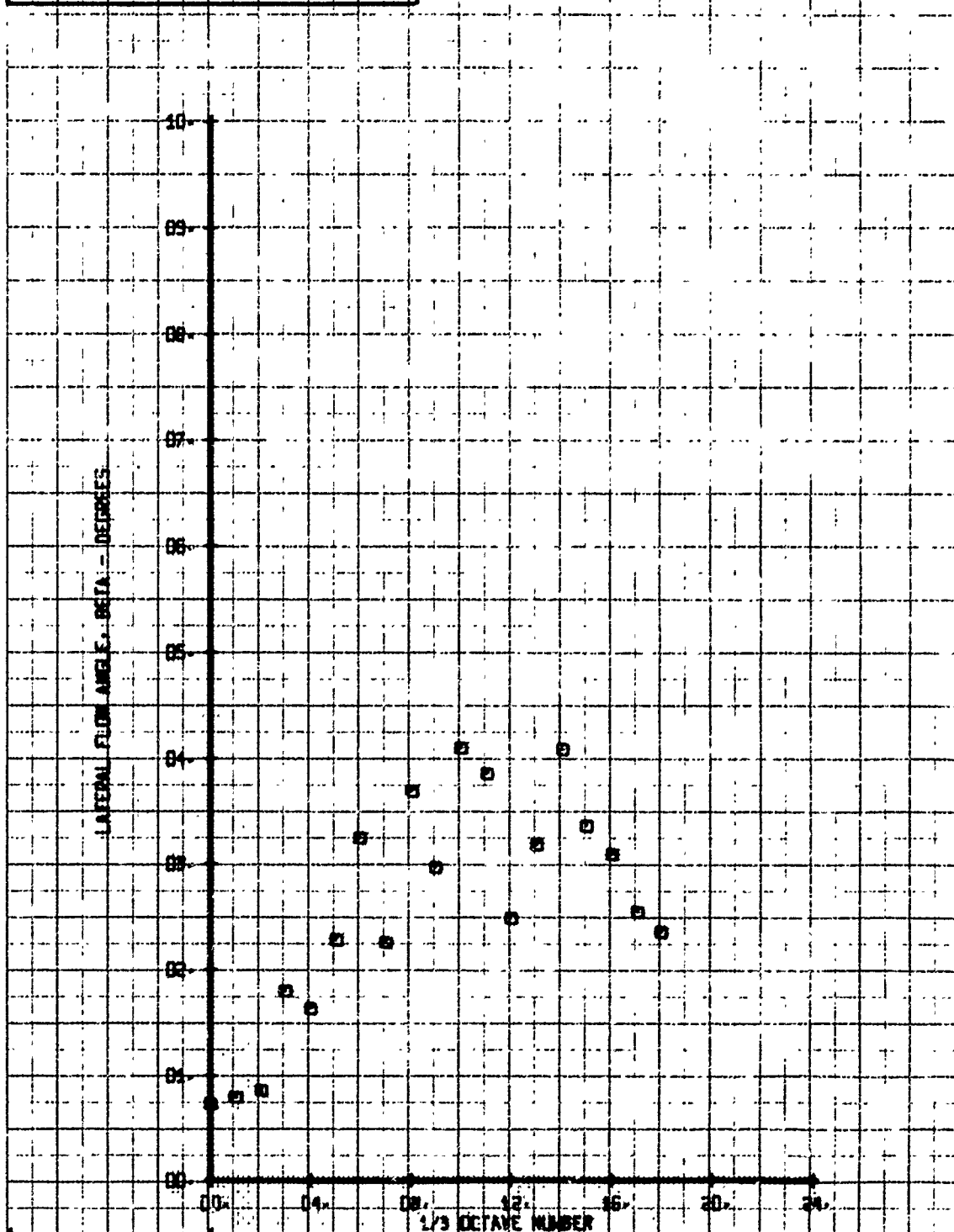
| LEGEND    |    |
|-----------|----|
| SYM       | CH |
| □         | 66 |
| PARAMETER |    |
| BETA      |    |

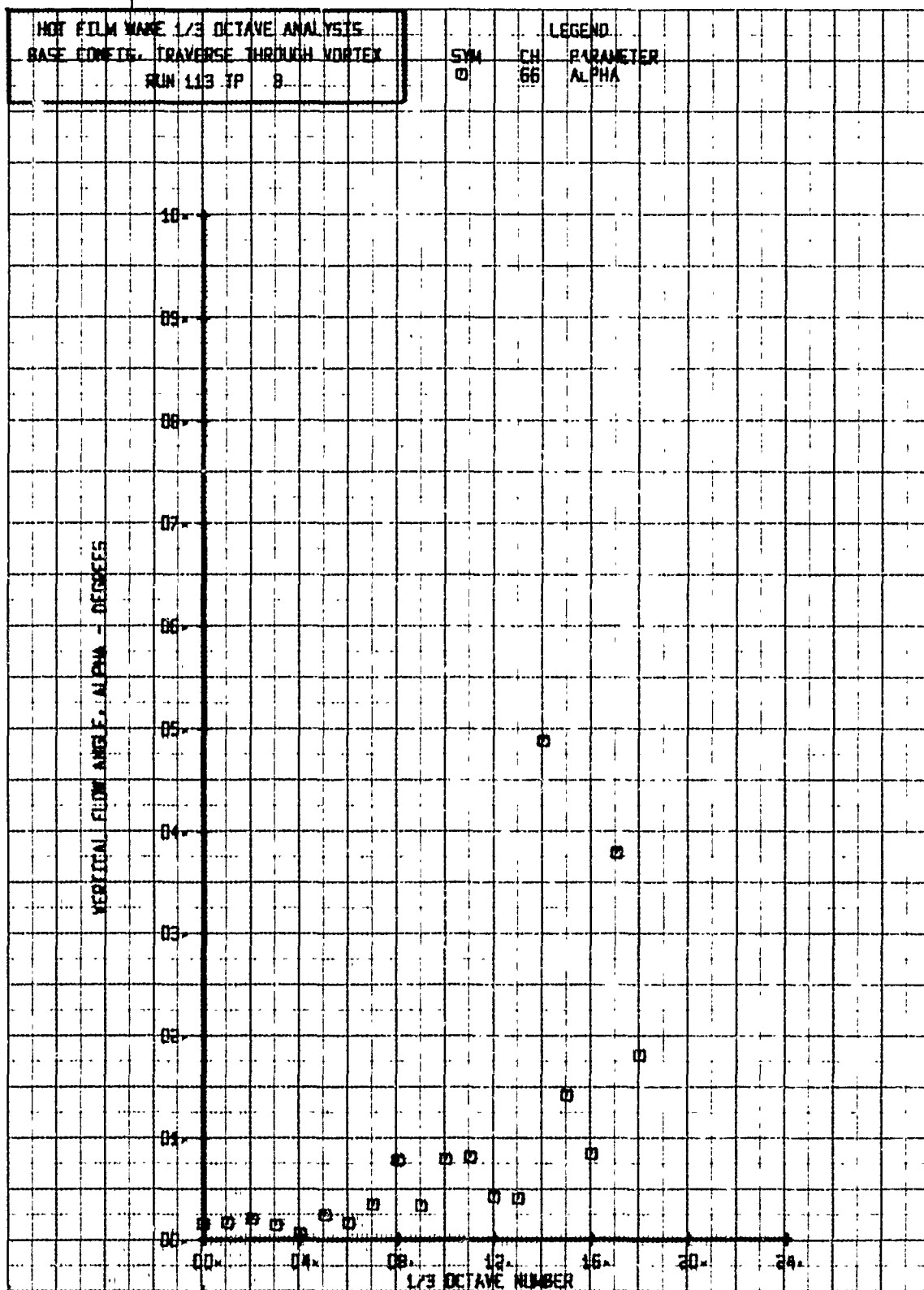
LATERAL FLOW ANGLE - BETA - DEGREES

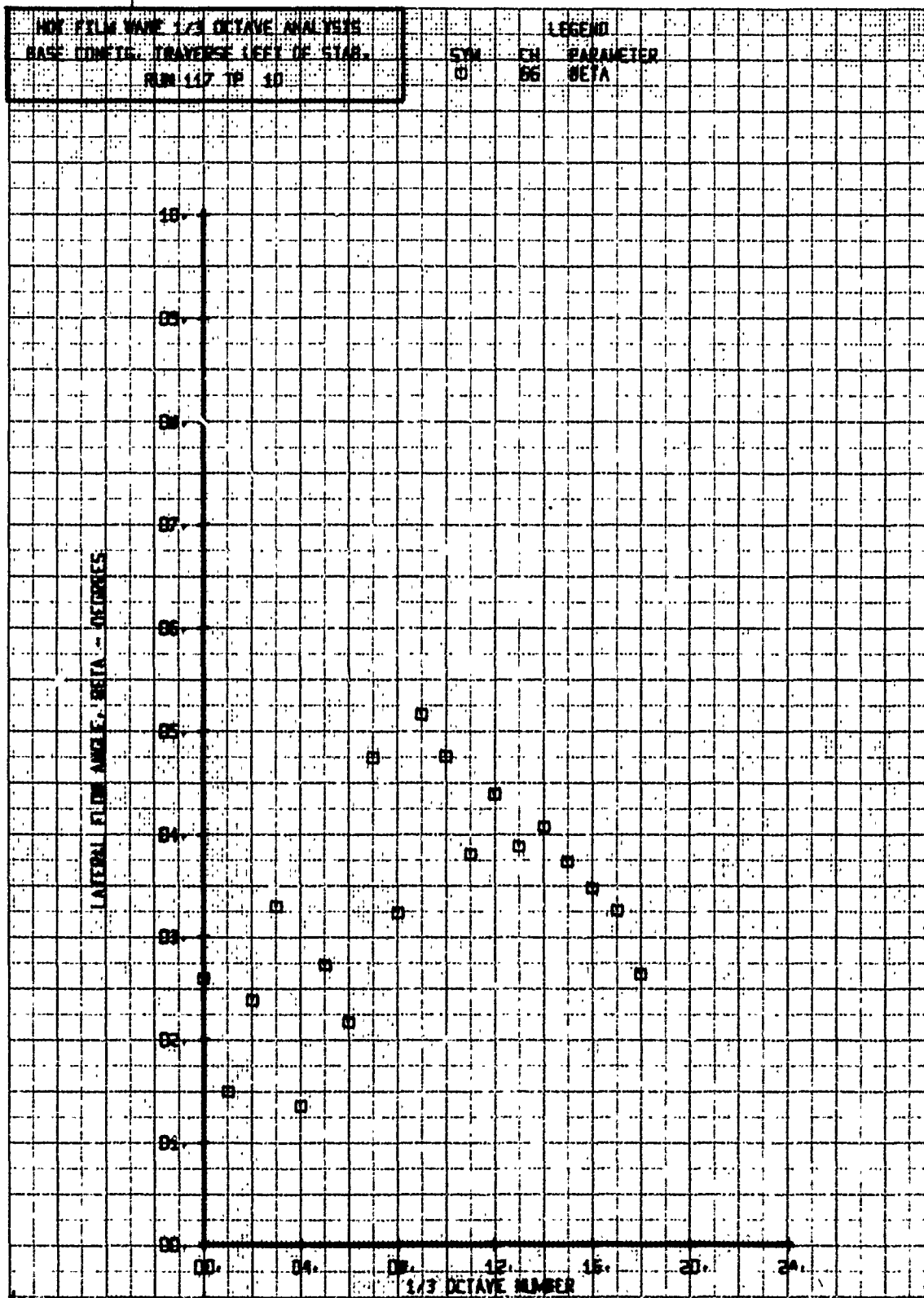


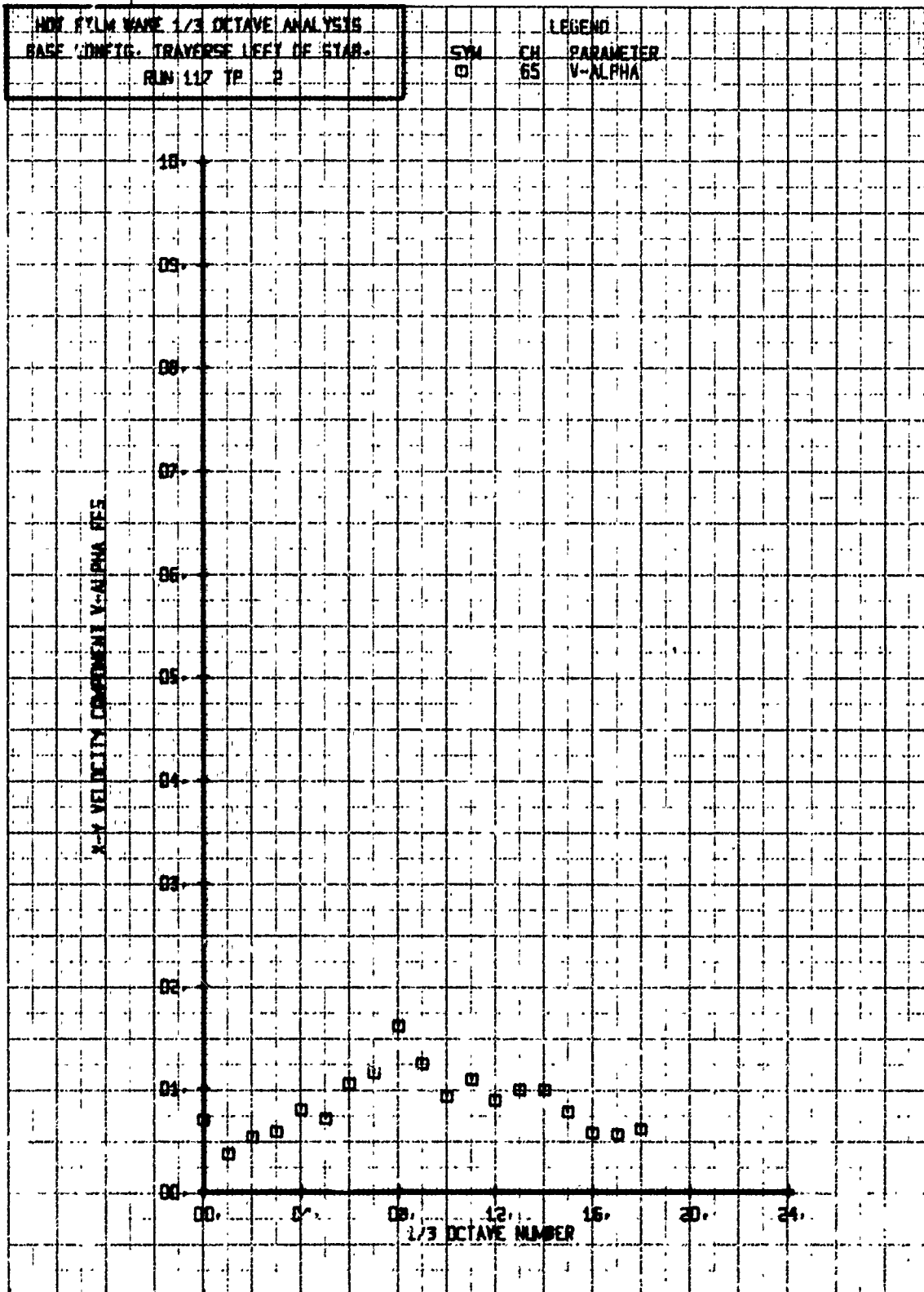
HOT FILM WAKE 1/3 OCTAVE ANALYSIS  
 BASE CONFIG. TRAVERSE LEFT OF STAB.  
 RUN 117 JP B

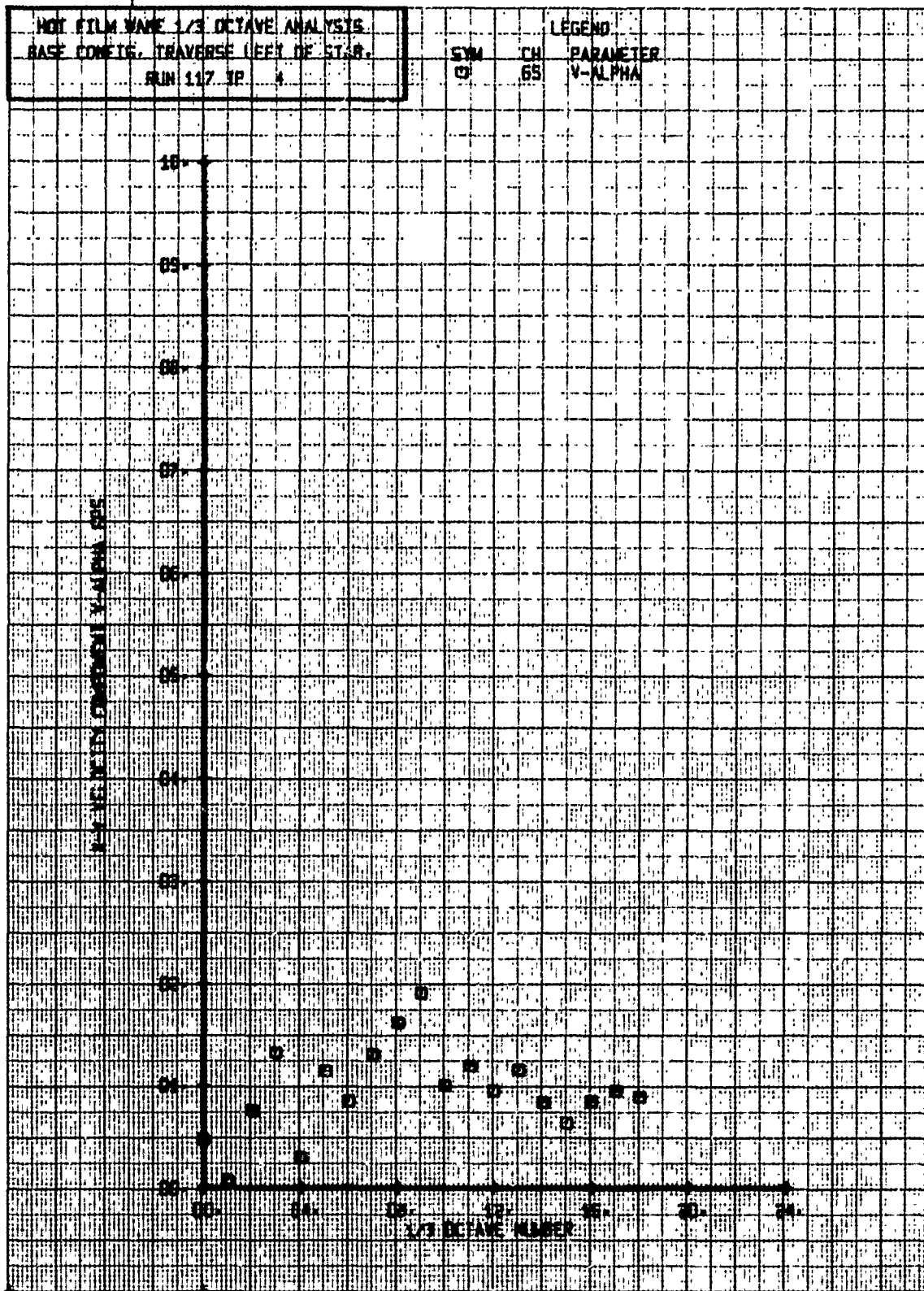
SYN CH PARAMETER  
 66 66 BETA









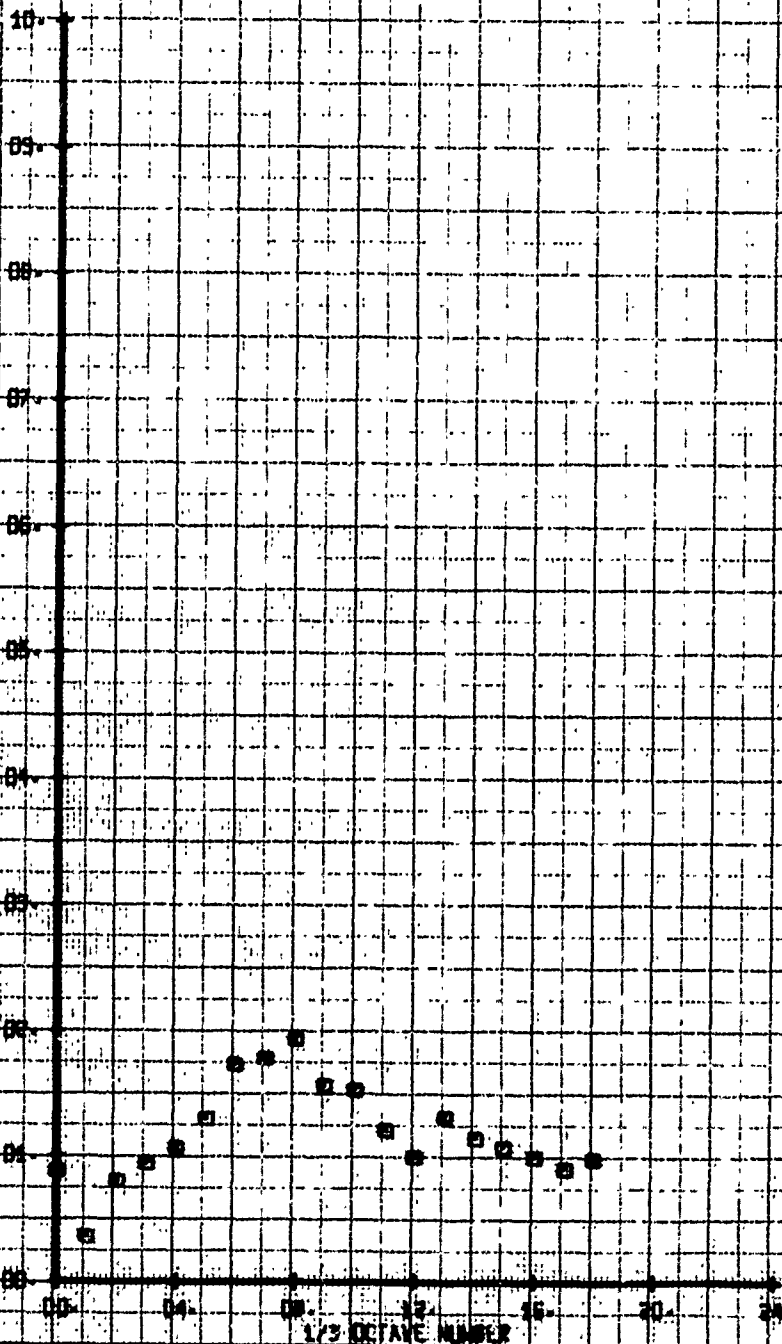


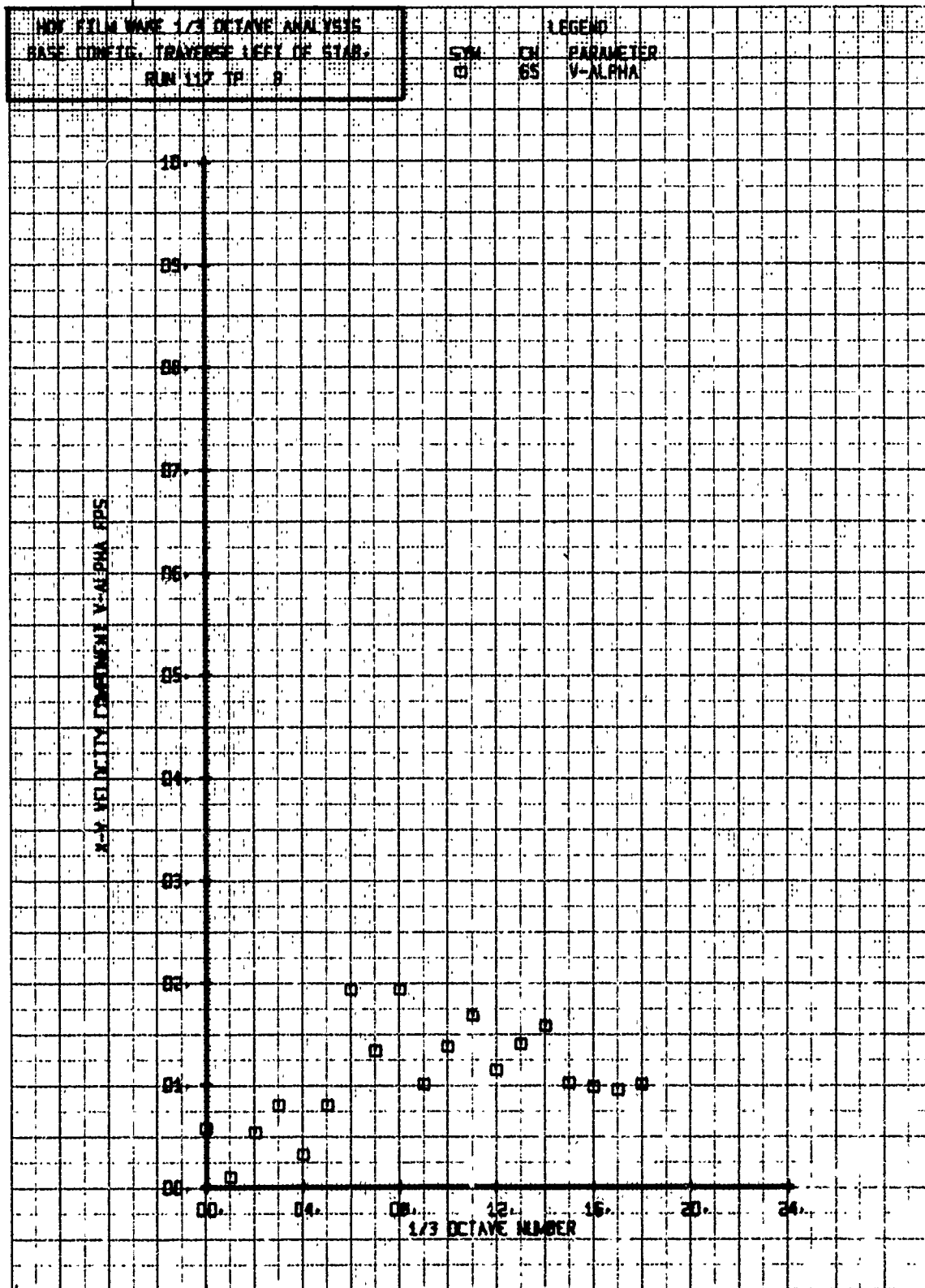


HOT FILM WAKE 1/3 OCTAVE ANALYSIS  
 BASE CONFIG. TRAVERSE LEFT OF STAG.  
 RUN 117 TP 6

SYN CH PARAMETER  
 0 65 V-ALPHA

V-ALPHA COMPONENT V-ALPHA RMS



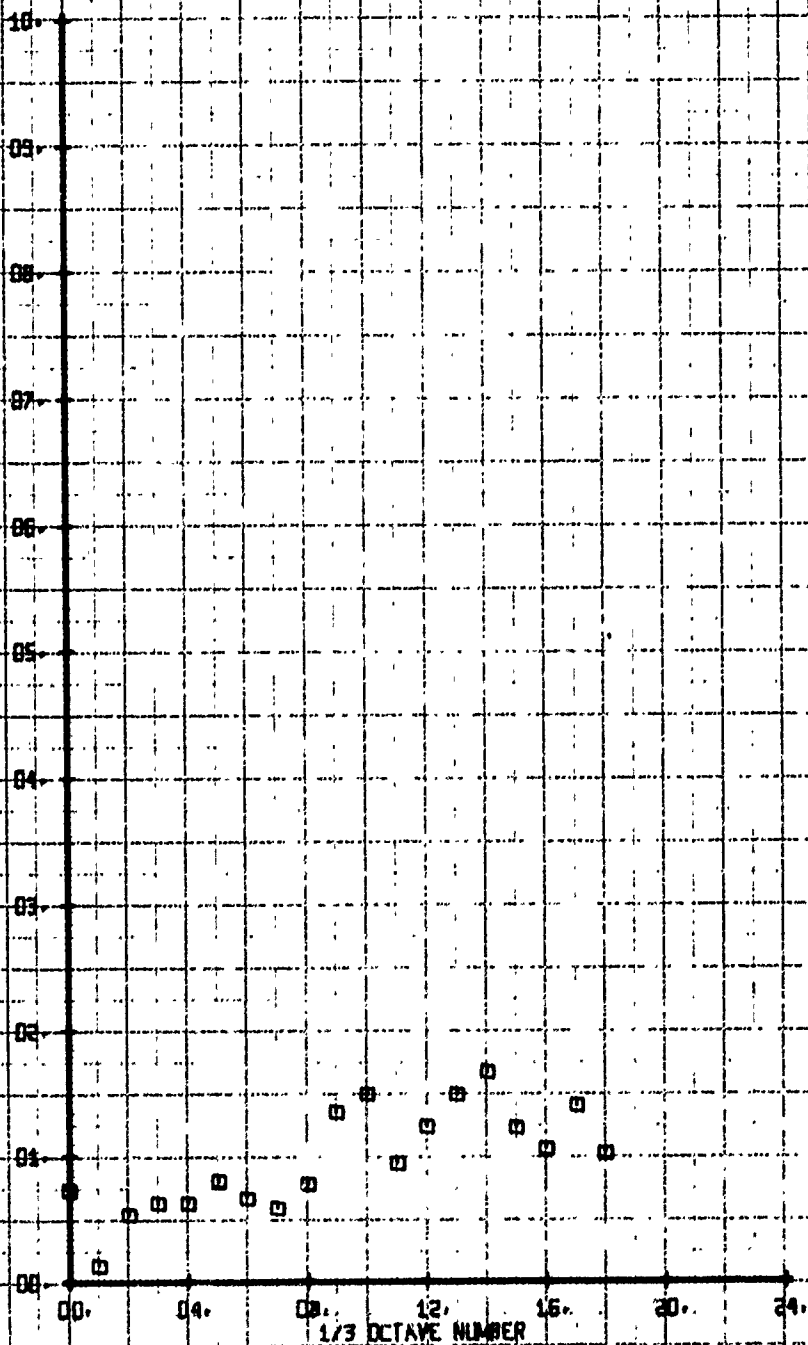


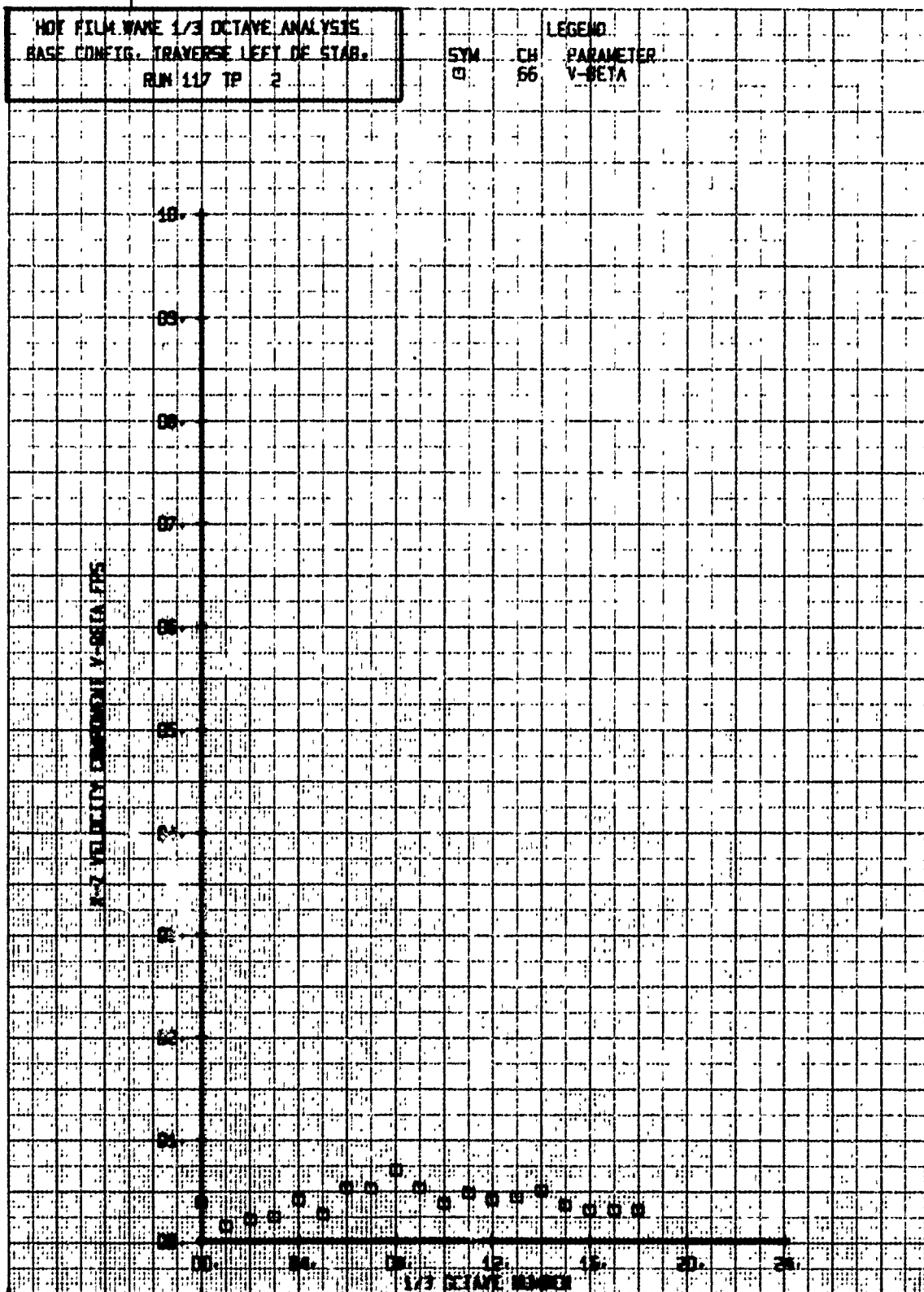
HOT FILM WAKE 1/3 OCTAVE ANALYSIS  
 BASE CONFIG. TRAVERSE LEFT OF STAR.  
 RUN 117 TP 10

SYM  
 □

LEGEND:  
 CH 65  
 PARAMETER  
 V-ALPHA

X-Y VELOCITY COMPONENT V-ALPHA PPS

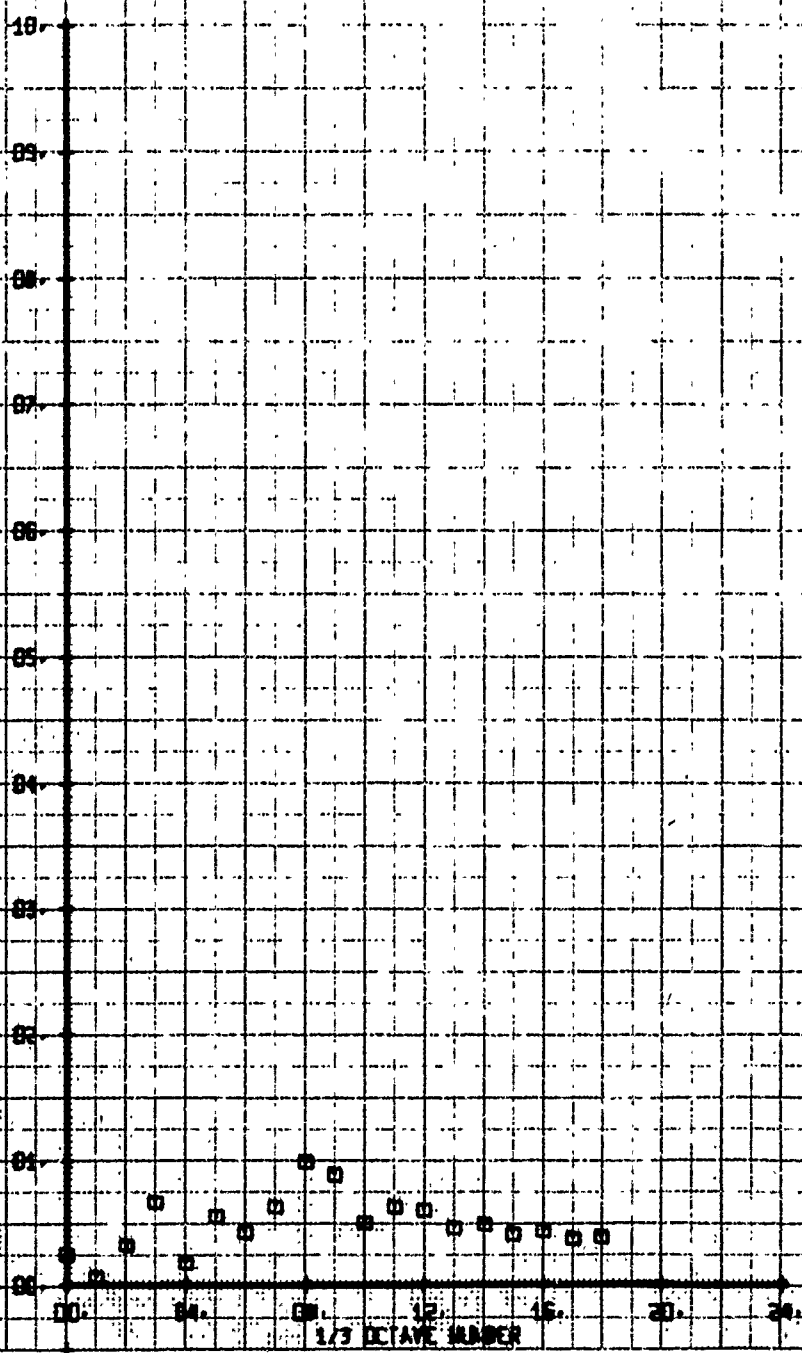




HOI FILM WAKE 1/3 OCTAVE ANALYSIS  
 BASE CONEIG. TRAVERSE LEFT OF STAB.  
 RUN 117 TP 4

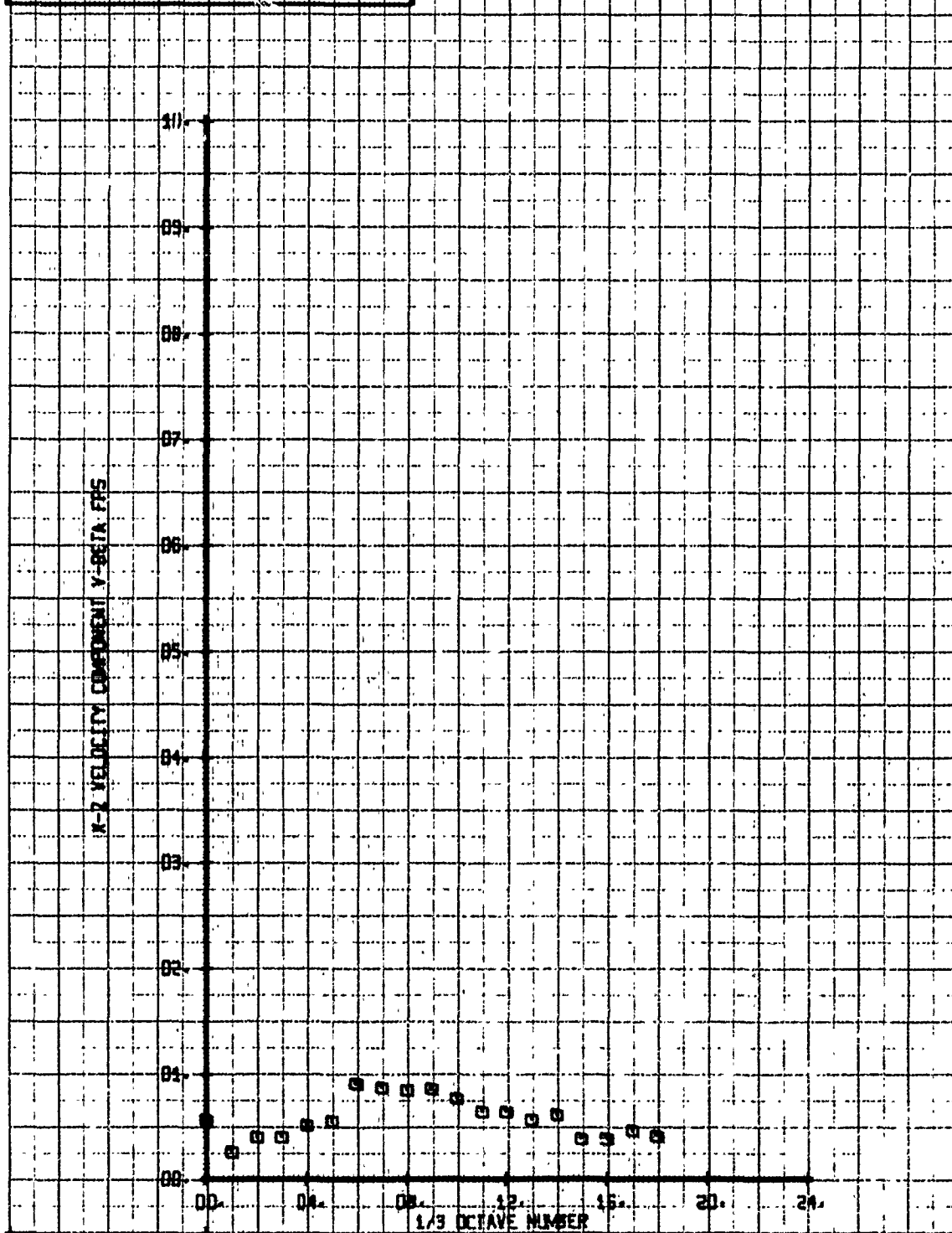
LEGEND  
 CH. 66  
 PARAMETER  
 V-BETA

1/3 VELOCITY COMPONENT V-BETA: FMS



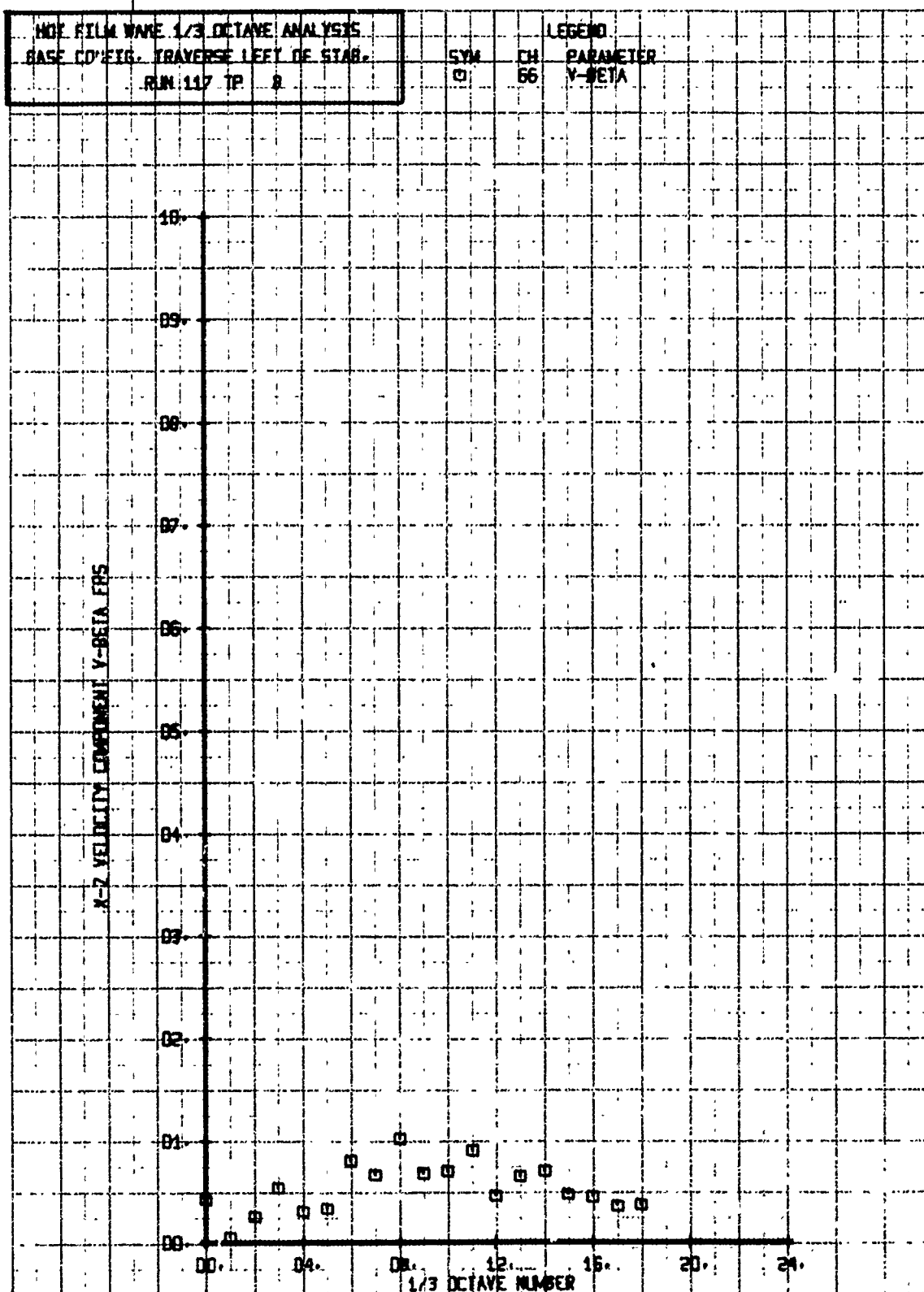
NO. 1 FILM WAVE 1/3 OCTAVE ANALYSIS  
 BASE TONE 16. TRAVERSE LEFT OF STAB.  
 RUN 112 TP 6

LEGEND  
 CH 56  
 PARAMETER  
 Y-BETA



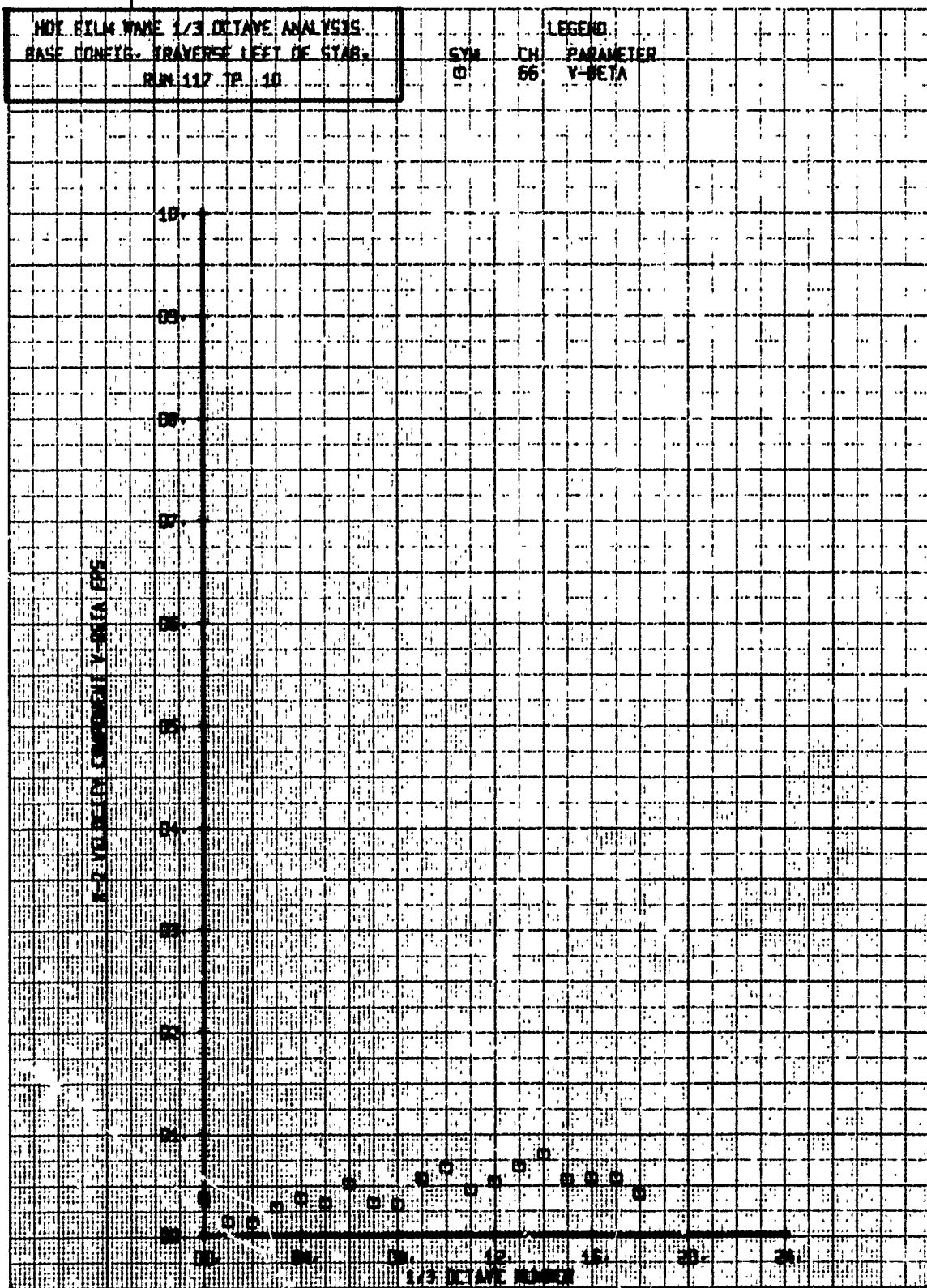
NOI FILM WAKE 1/3 OCTAVE ANALYSIS  
 BASE CO'FIG. TRAVERSE LEFT OF STAR.  
 RUN 117 TP. 2

SYN CH  
 01 66  
 LEGEND  
 PARAMETER  
 Y-BETA

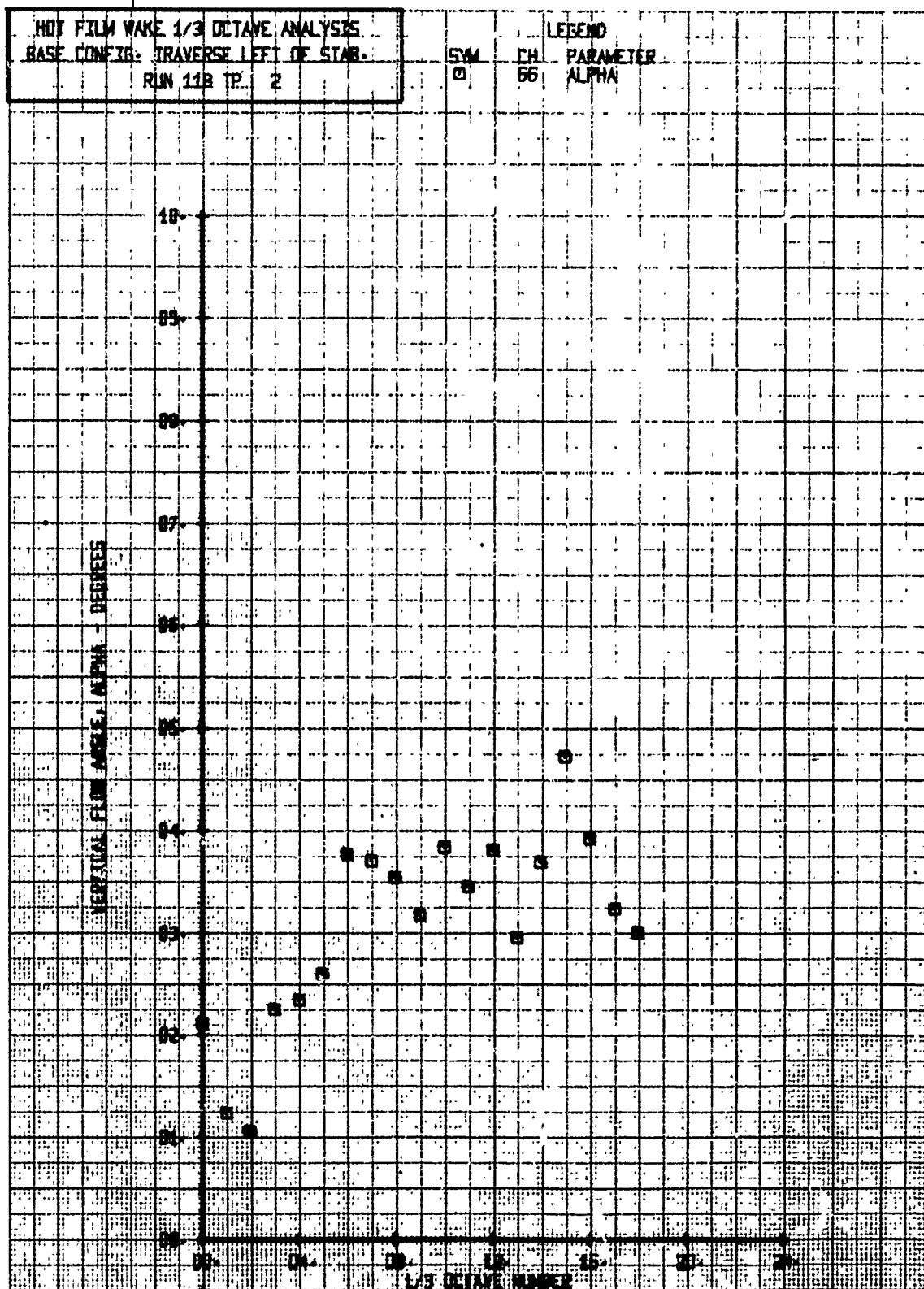


HOT FILM WIRE 1/3 OCTAVE ANALYSIS  
 BASE CONFIG. TRAVERSE LEFT OF STAR.  
 RUN 117 TP. 10

SYN CH PARAMETER  
 01 56 V-BETA

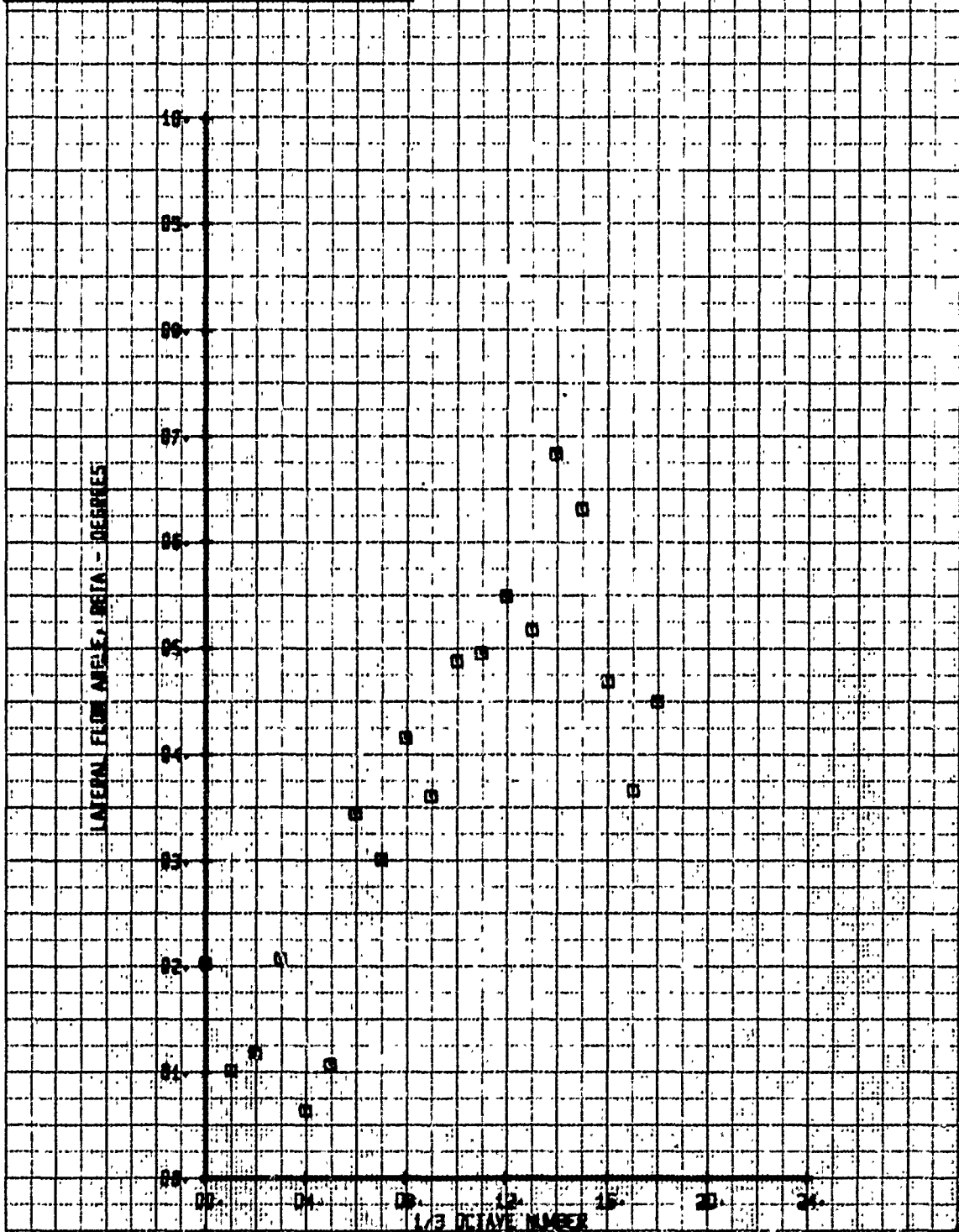






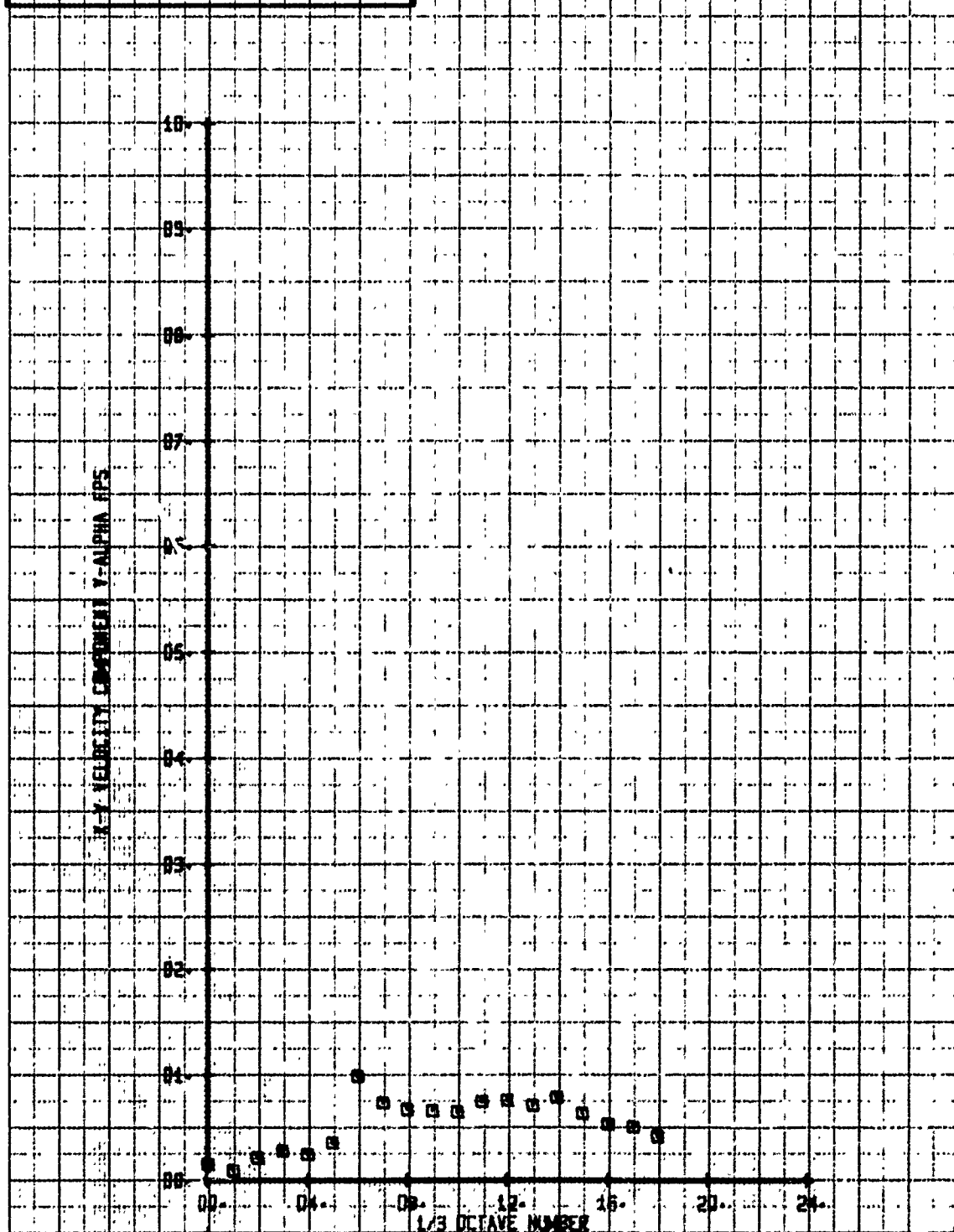
HOT FILM WAKE 1/3 OCTAVE ANALYSIS  
 BASE CONE TR. TRAVERSE LEFT OF STAB.  
 RUN 118 TP. 2

SYM CH PARAMETER  
 0 55 BETA



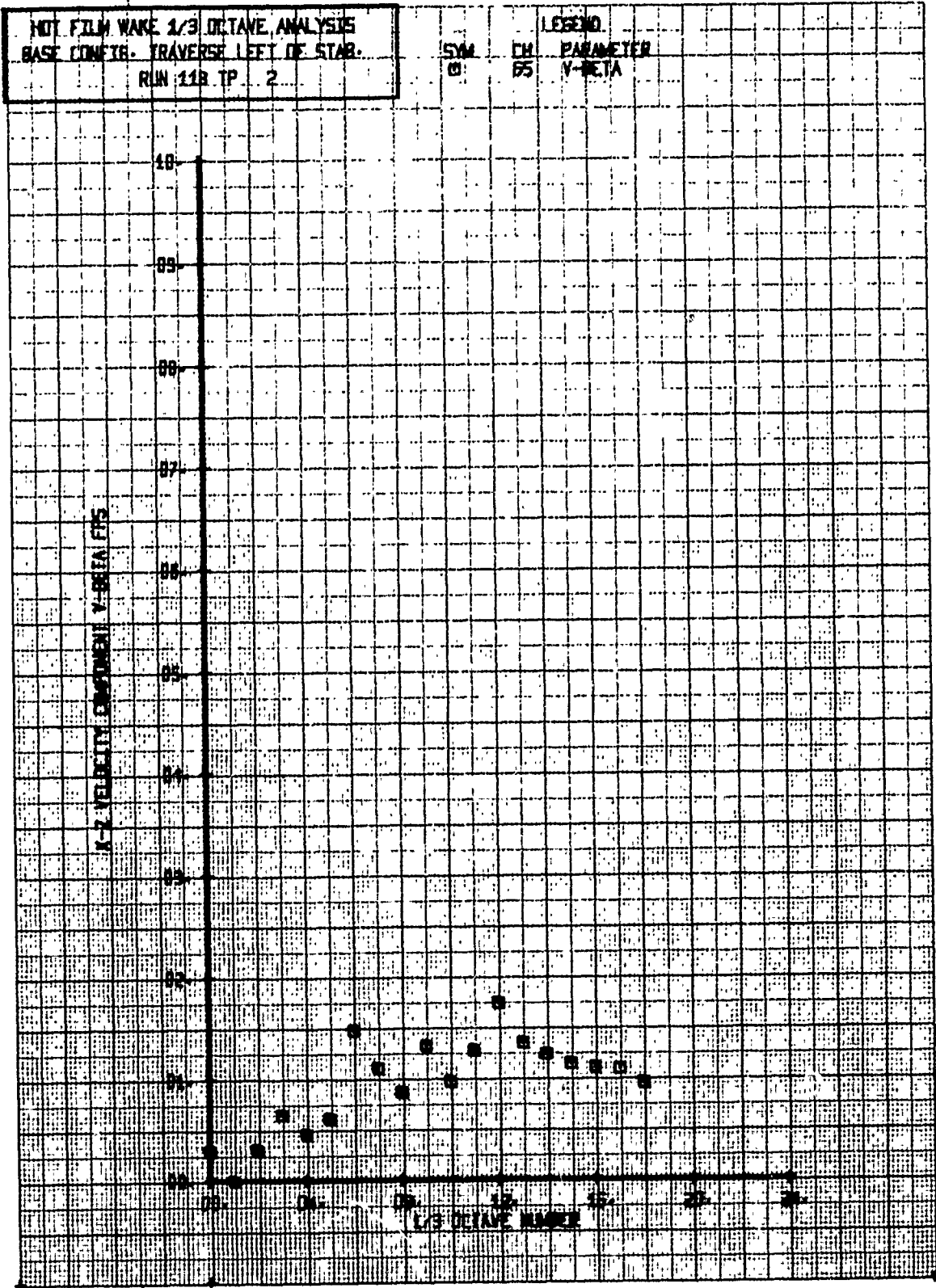
HOT FILM WAKE 1/3 OCTAVE ANALYSIS  
 BASE CONE TR. TRAVERSE LEFT OF STAR.  
 RUN 11B TP. 2

| SYM | CH | LEGEND | PARAMETER |
|-----|----|--------|-----------|
| Q   | 56 |        | V-ALPHA   |



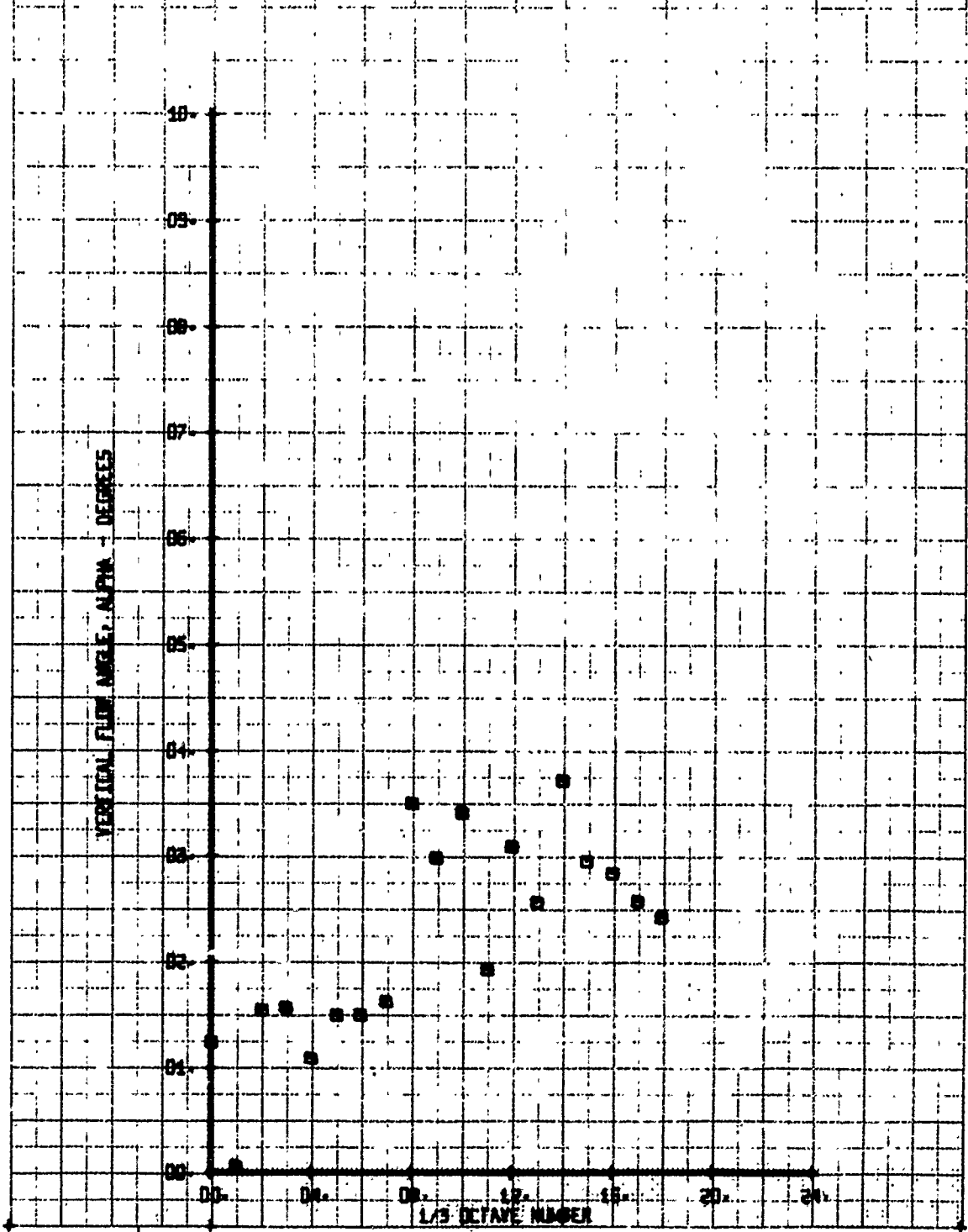
HOT FILM WAKE 1/3 OCTAVE ANALYSIS  
 BASE CORRECTED TRAVERSE LEFT OF STAR.  
 RUN 11B TP 2

| SYM | CH | PARAMETER |
|-----|----|-----------|
| 0   | 65 | V-BETA    |



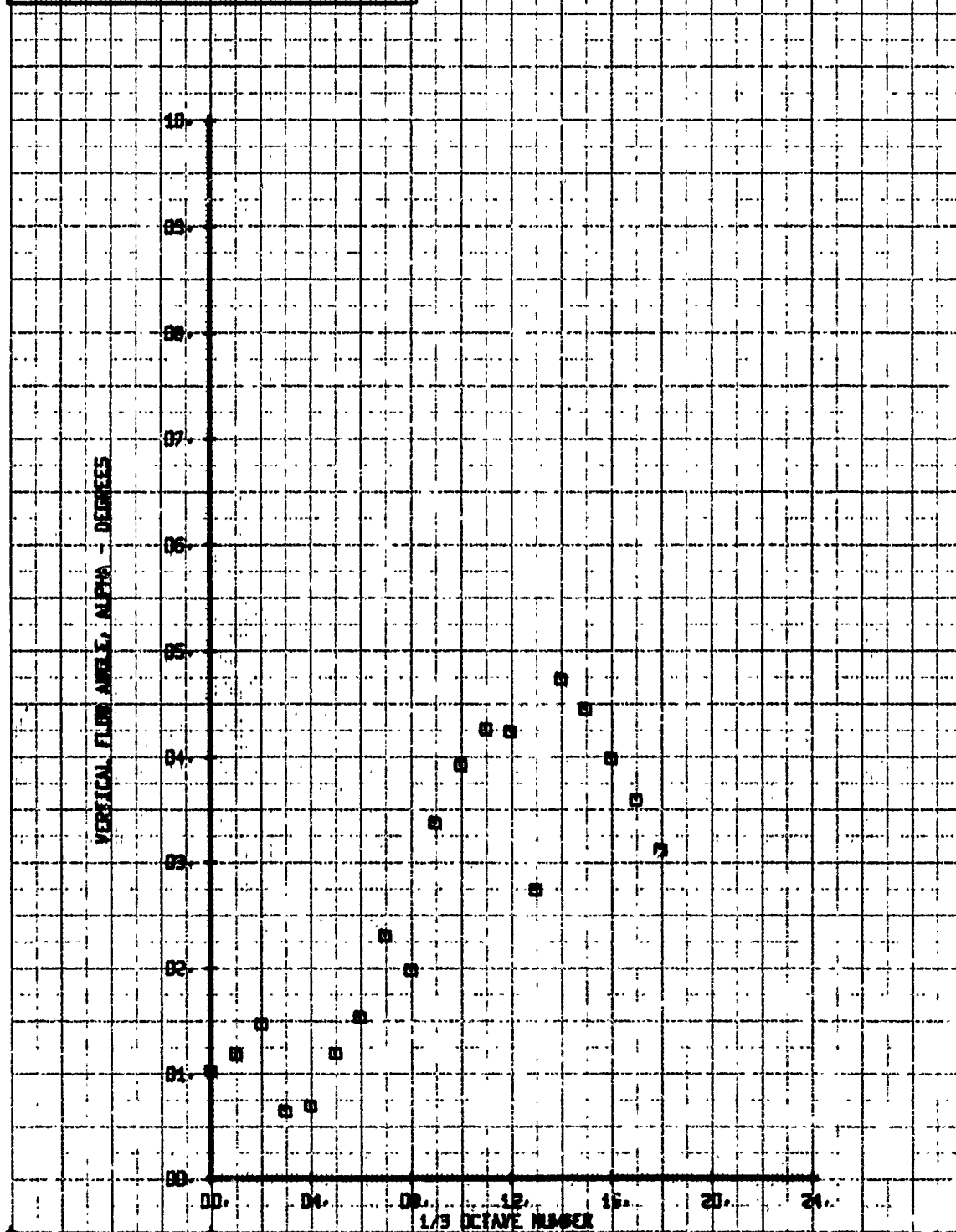
HOT FILM WAKE 1/3 OCTAVE ANALYSIS  
 BASE CONFIG. TRAVERSE RT. DE STAB.  
 RUN 113 TP 2

SYN CH  
 0 65  
 LEGEND  
 PARAMETER  
 ALPHA



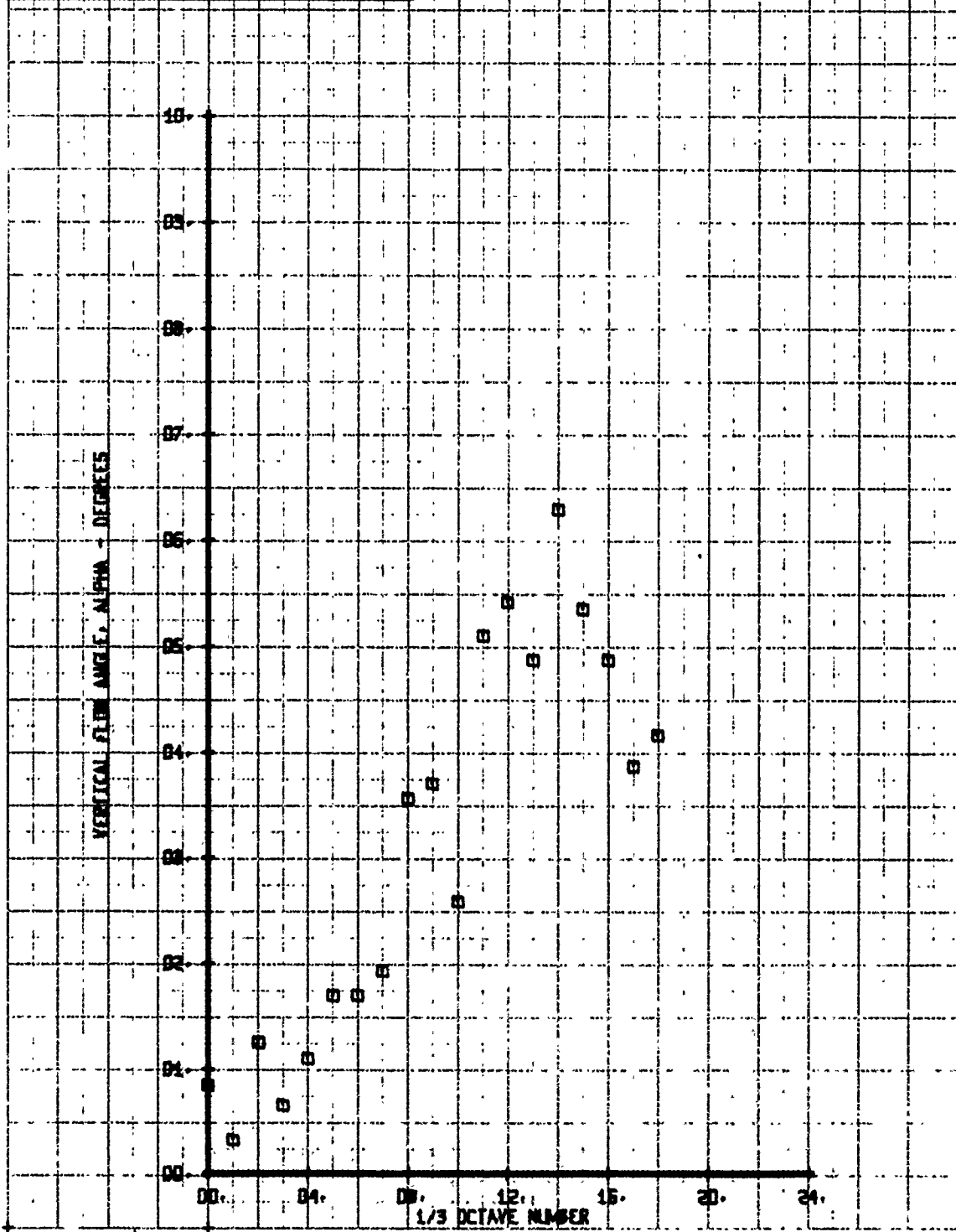
HOT FILM WAKE 1/3 OCTAVE ANALYSIS  
 BASE CORRECTION TRAVERSE RT. OF STAB.  
 RUN 113 TP. 5

SYM CH  
 ( ) BS  
 LEGEND  
 PARAMETER  
 ALPHA



HOT FILM WAVE 1/3 OCTAVE ANALYSIS  
 BASE CONFIG. TRAVERSE HT. OF STAR.  
 RUN 113 TP 8

SYM CH  
 01 65  
 PARAMETER  
 ALPHA

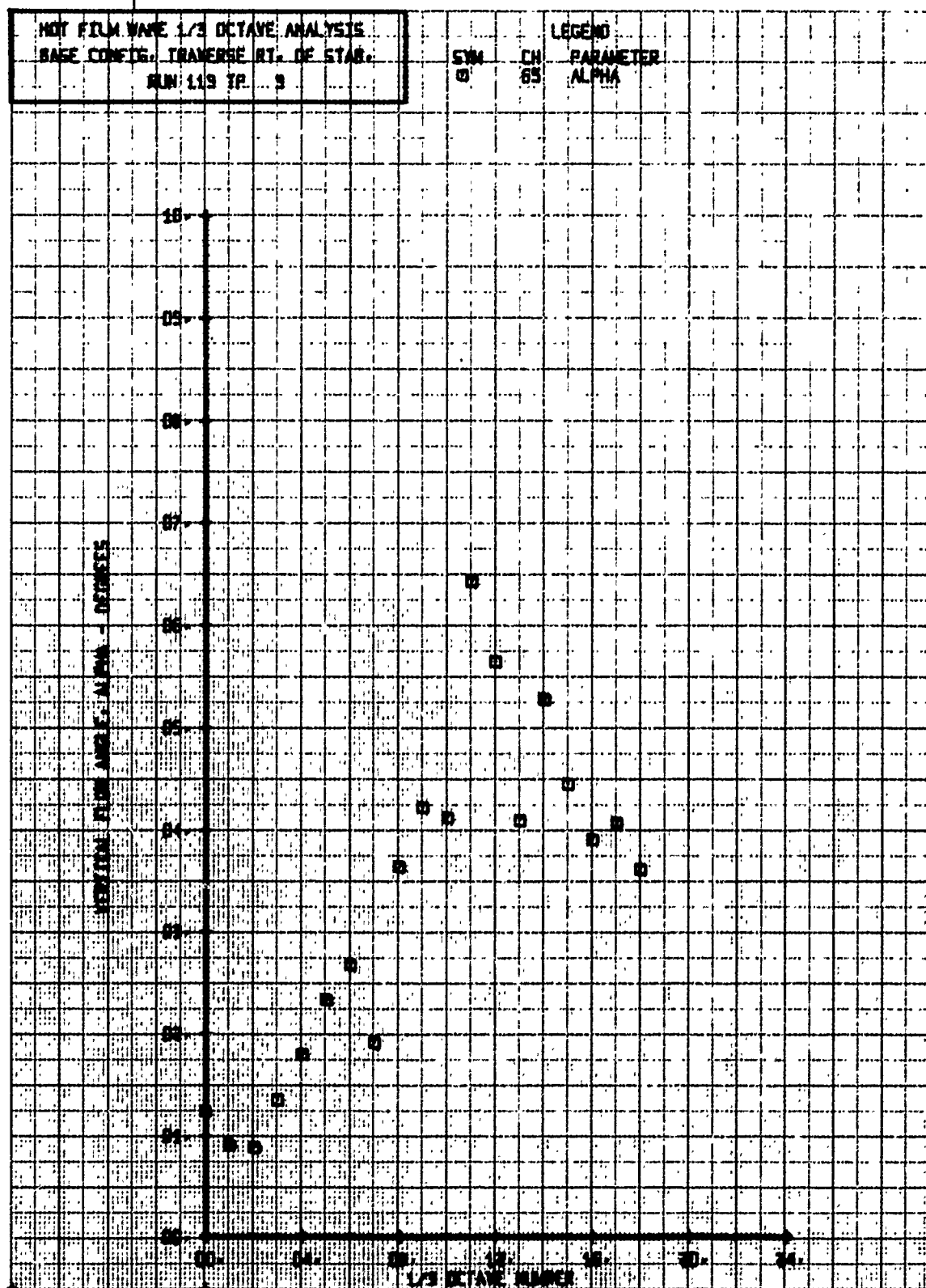


HOT FILM WAKE 1/3 OCTAVE ANALYSIS  
 BASE CONFIG. TRAVERSE RT. OF STAR.  
 RUN 119 TP. 3

SYM  
 0

CH  
 65

LEGEND  
 PARAMETER  
 ALPHA





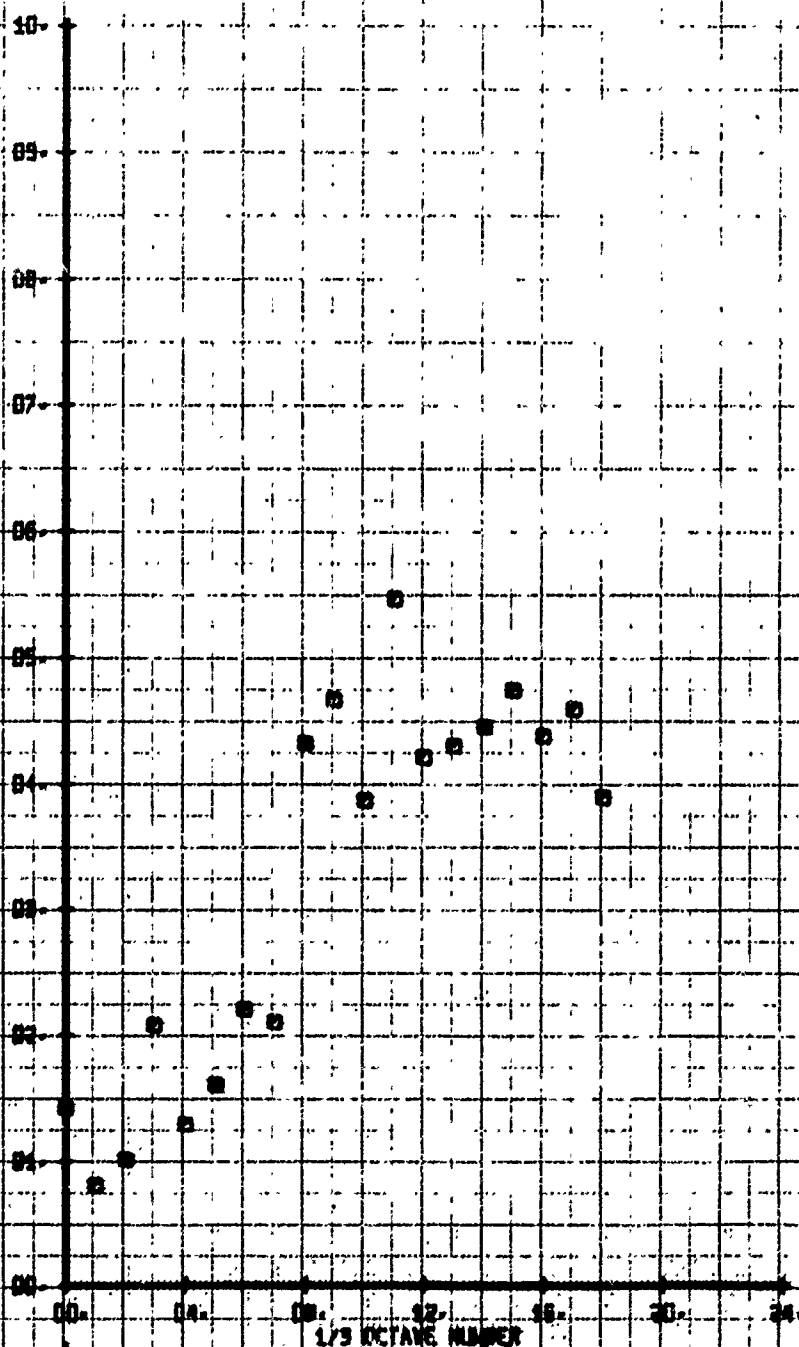
HOT FILM WAVE 1/3 OCTAVE ANALYSIS  
 BASE CONFIG. TRAVERSE RT. OF STAB.  
 RUN 119 TP 12

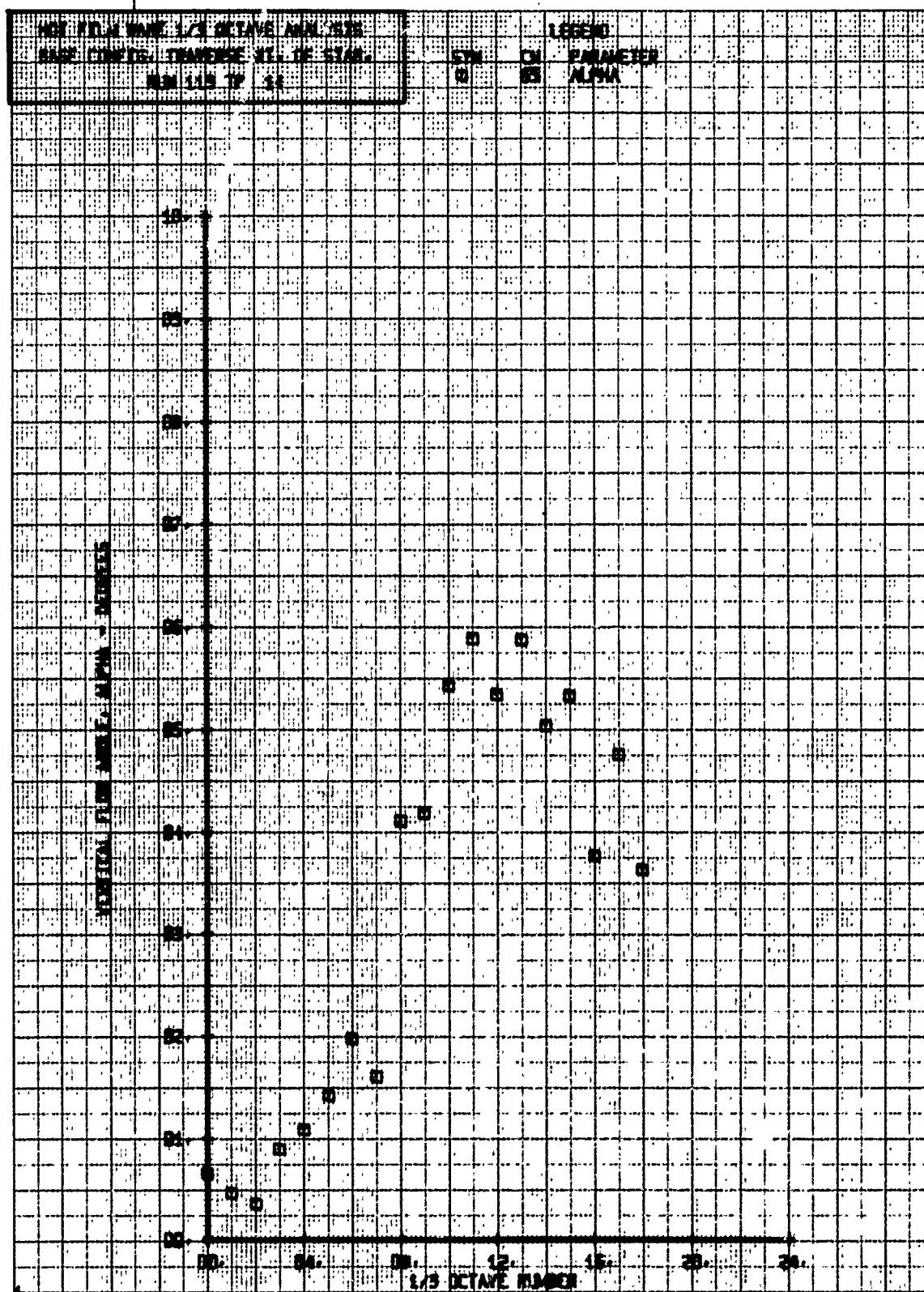
SYM  
 0

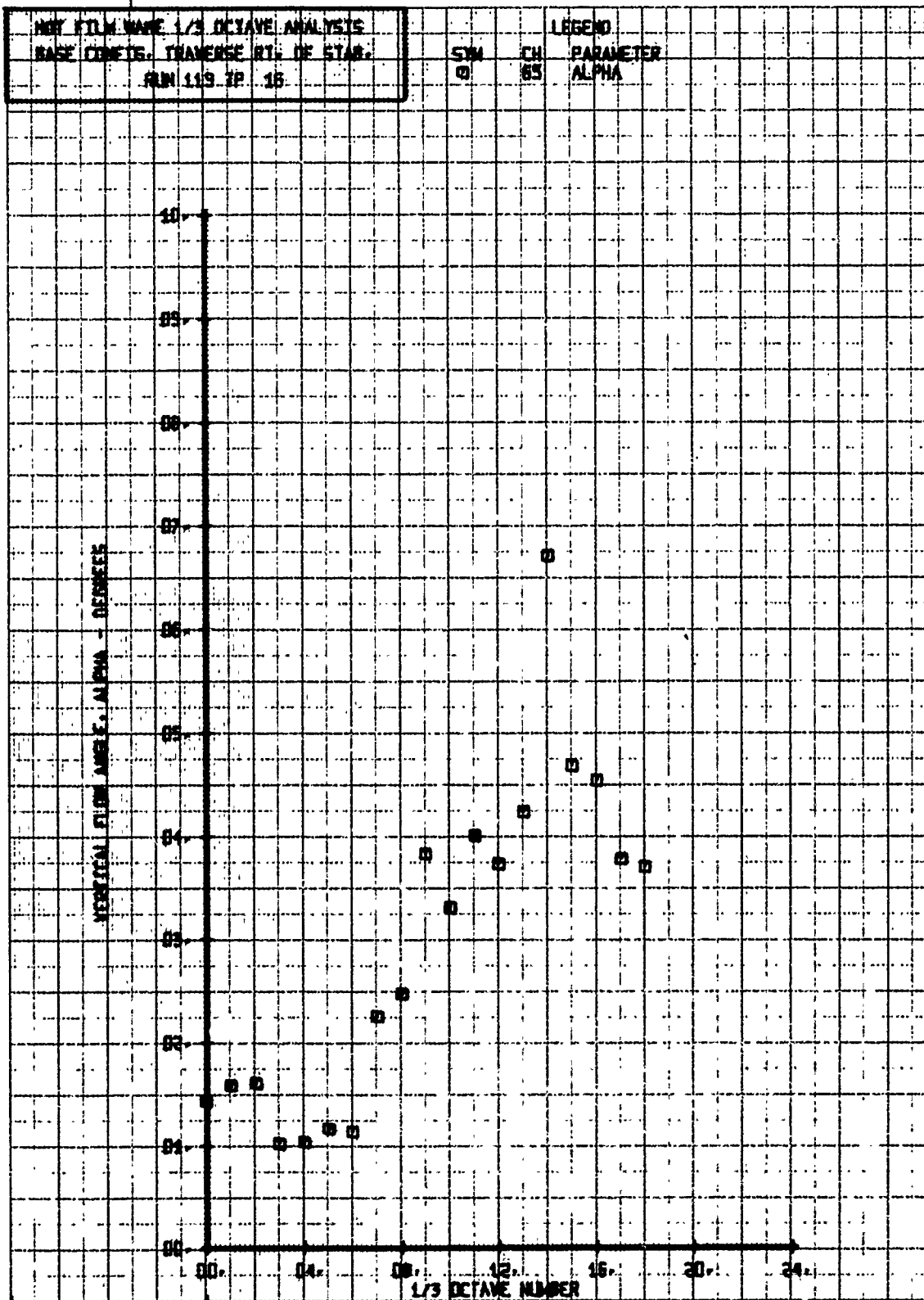
CH  
 65

LEGEND  
 PARAMETER  
 ALPHA

VERTICAL FLUX ANGLE, ALPHA - DEGREES

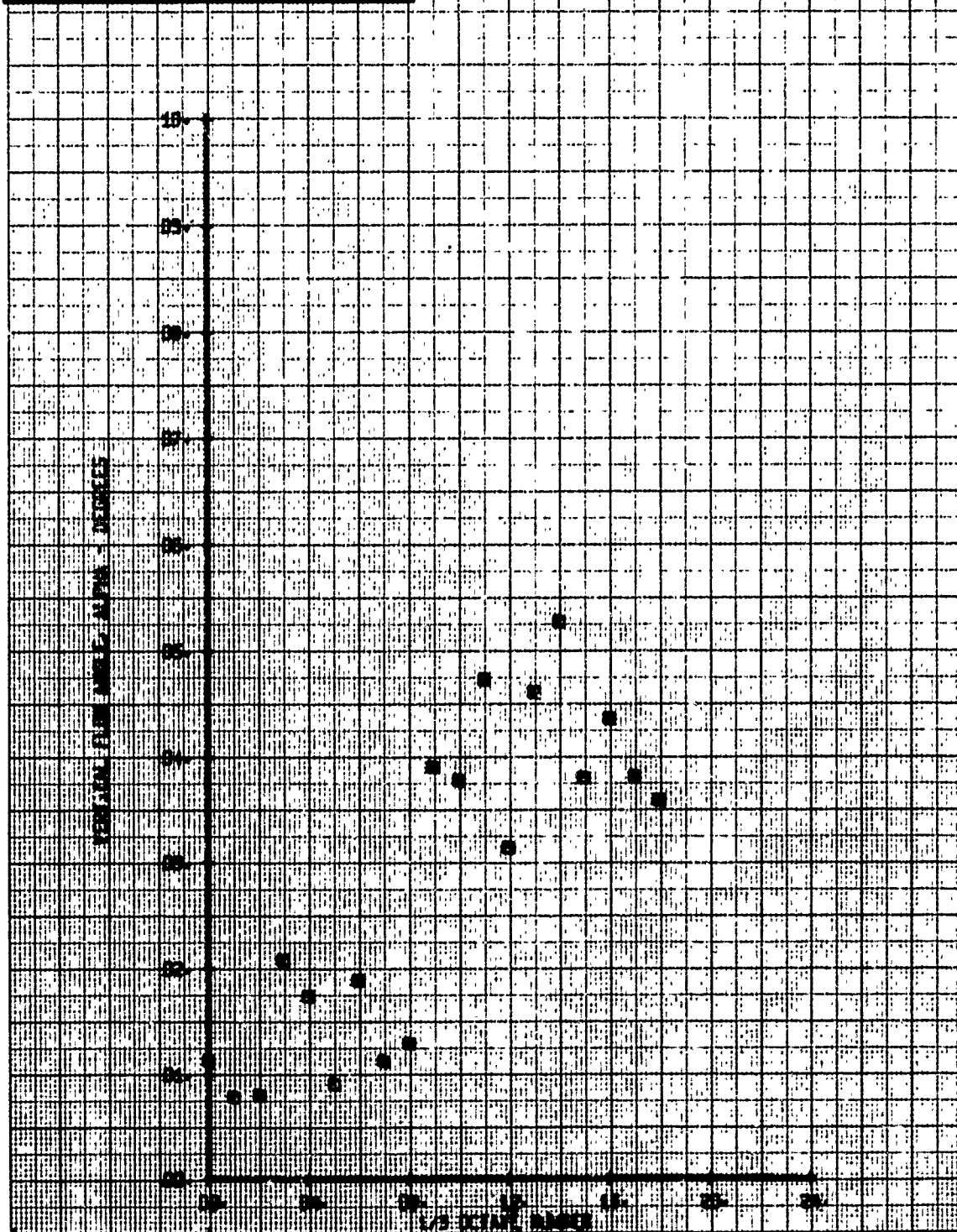






HOT FILM WAKE 1/3 OCTAVE ANALYSIS  
 BASE CORRECTION TRAVERSE RT. OF STAB.  
 RUN 113 TP 28

SYN CH  
 01 65  
 LEGEND  
 PARAMETER  
 ALPHA

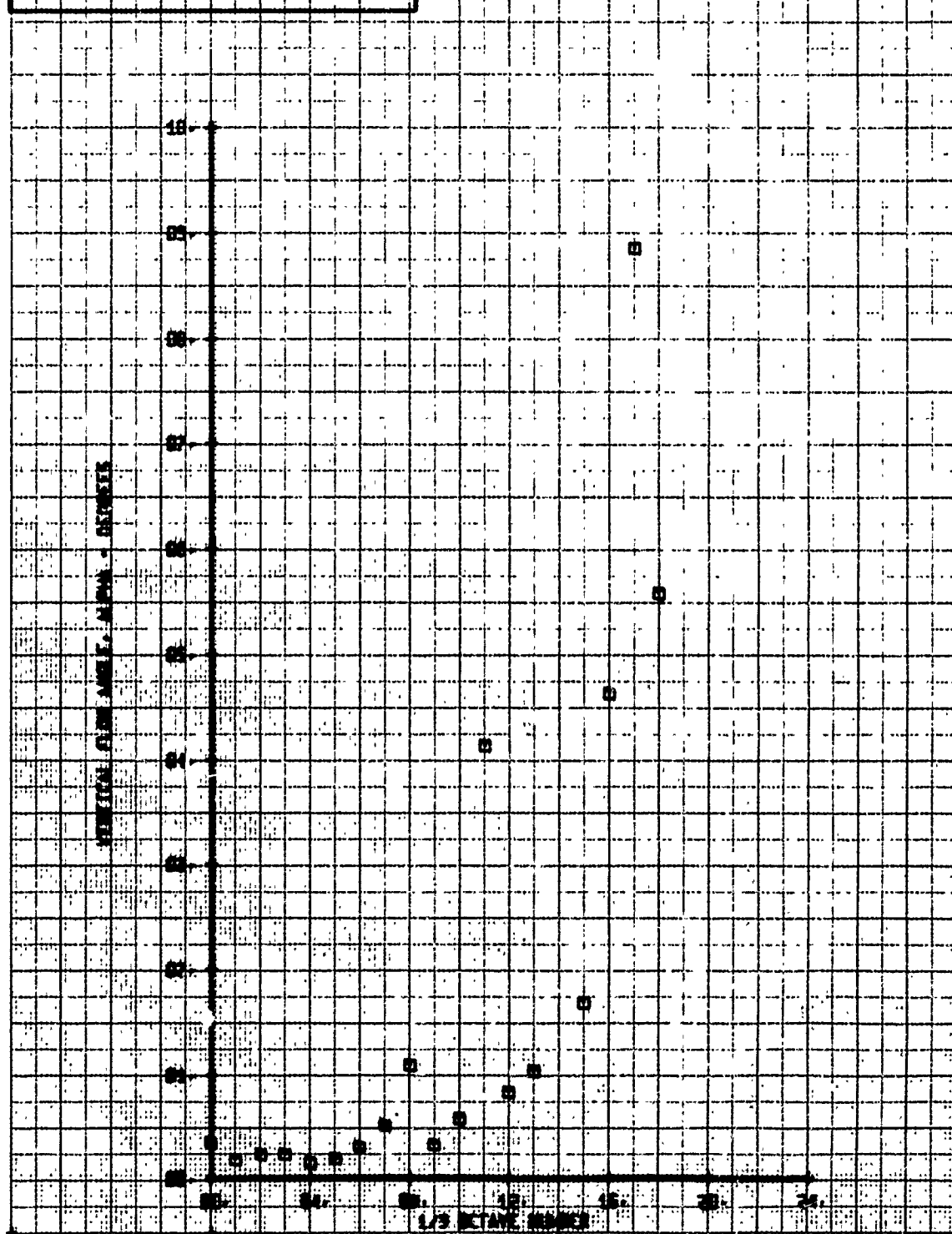


NOF FILM WAVE 1/3 OCTAVE ANALYSIS  
 BASE TONIC, TRAVERSE RT. OF STAR.  
 RUN 119 TP. 25

SYM  
 01

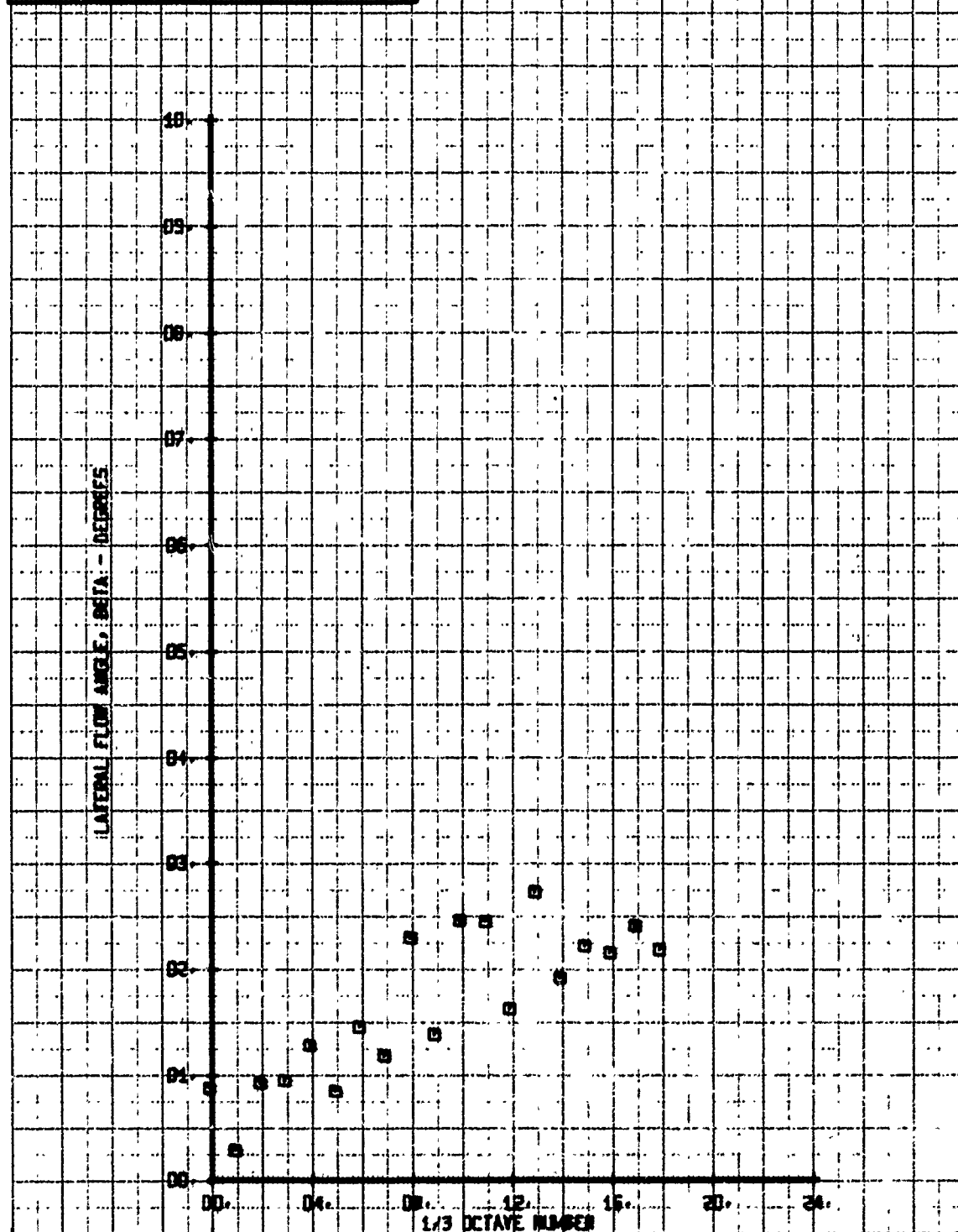
CH  
 65

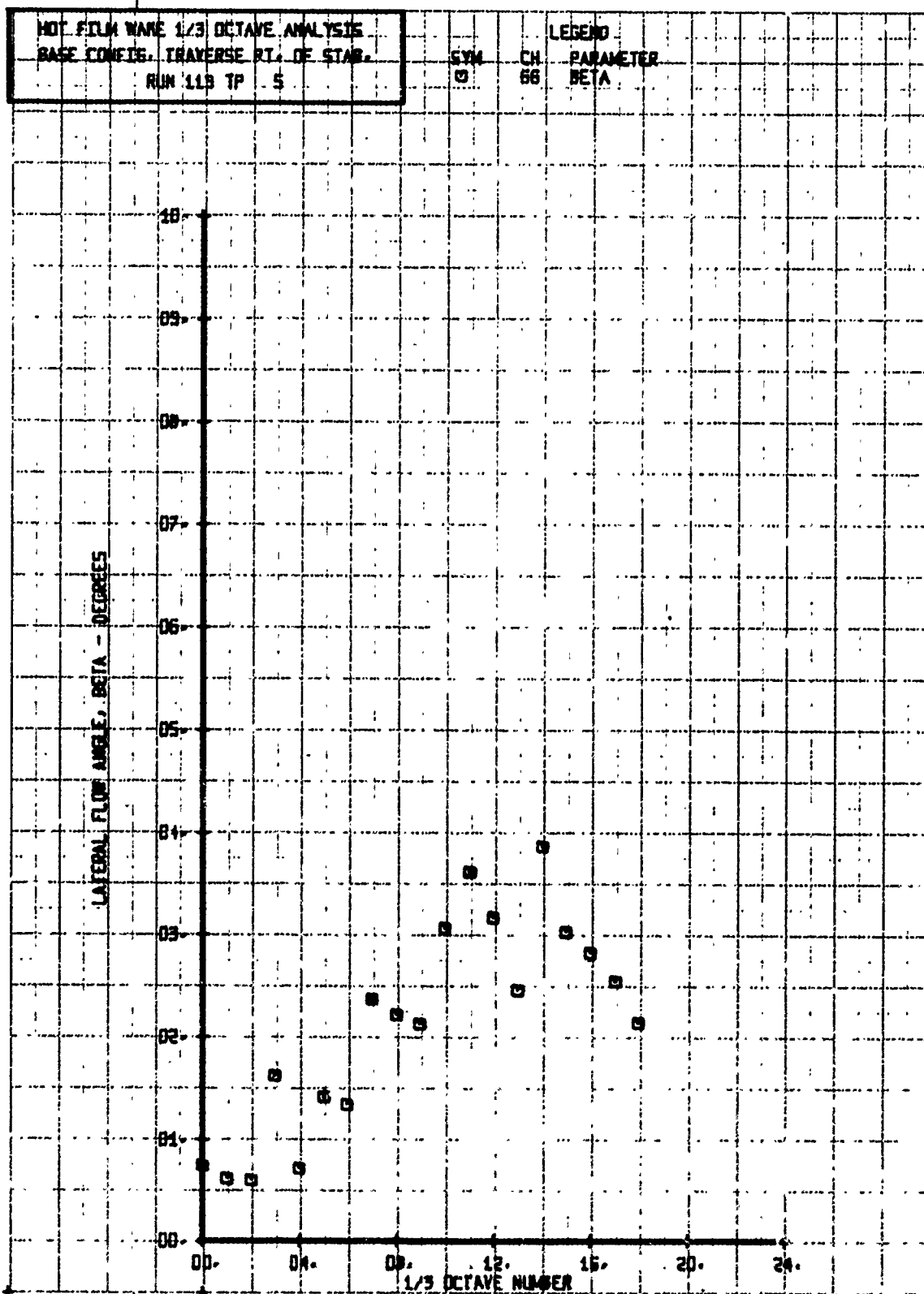
LEGEND  
 PARAMETER  
 ALPHA

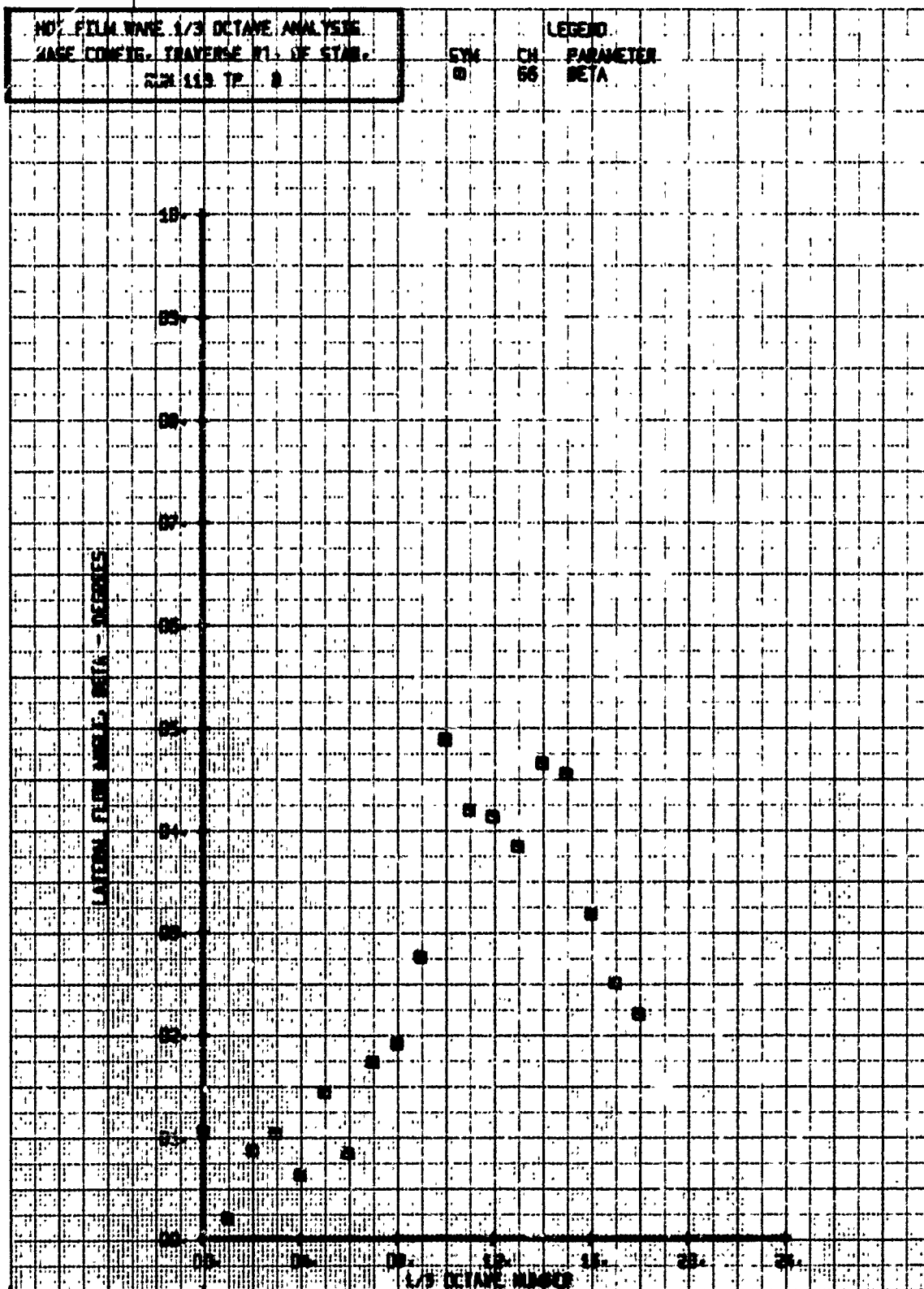


NOY FILM WIRE 1/3 OCTAVE ANALYSIS  
 BASE CONEIG. TRAVERSE RT. OF STAR.  
 RUN 113 TP. 2

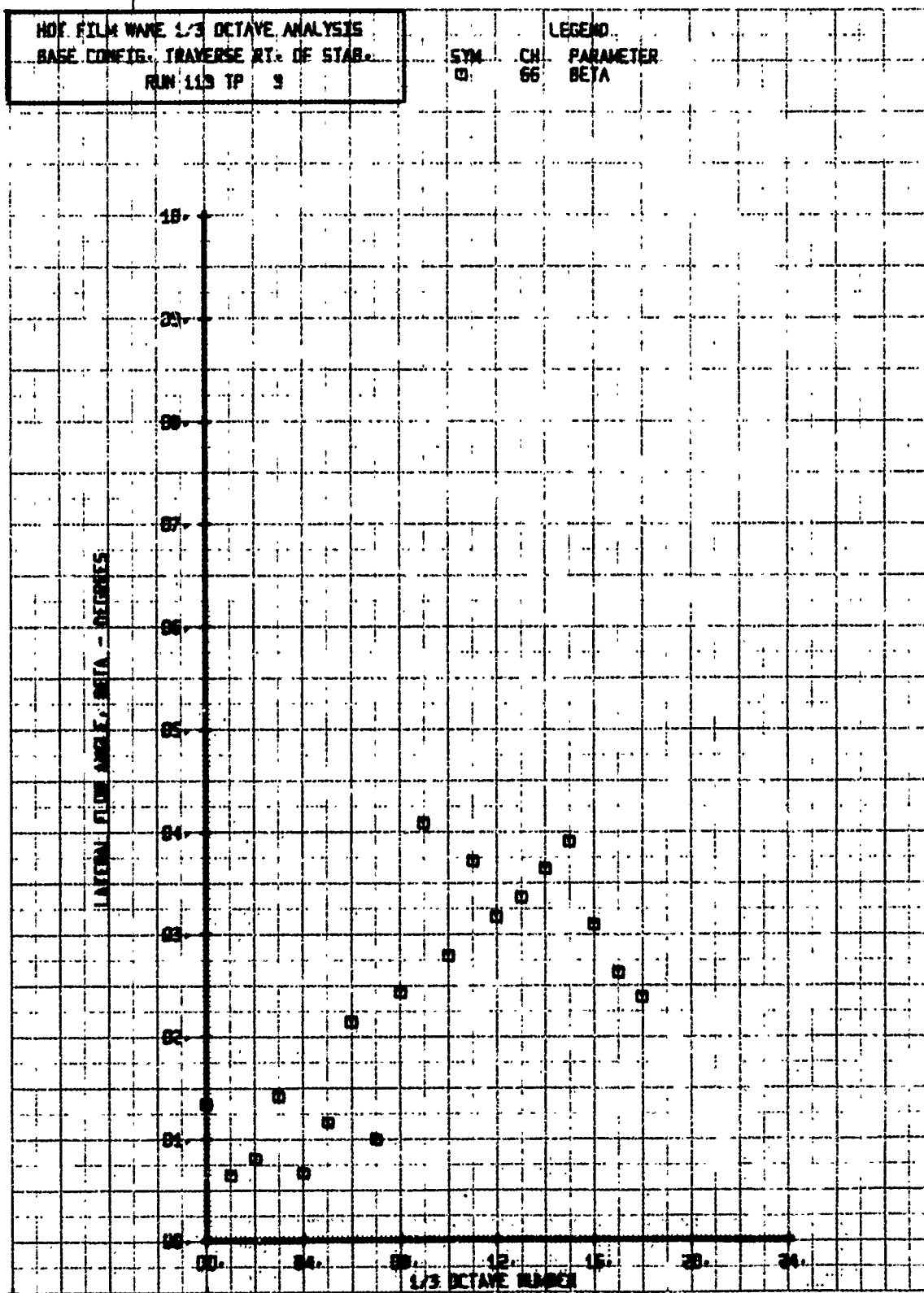
| SYM | CH | LEGEND | PARAMETER |
|-----|----|--------|-----------|
| 0   | 66 |        | BETA      |

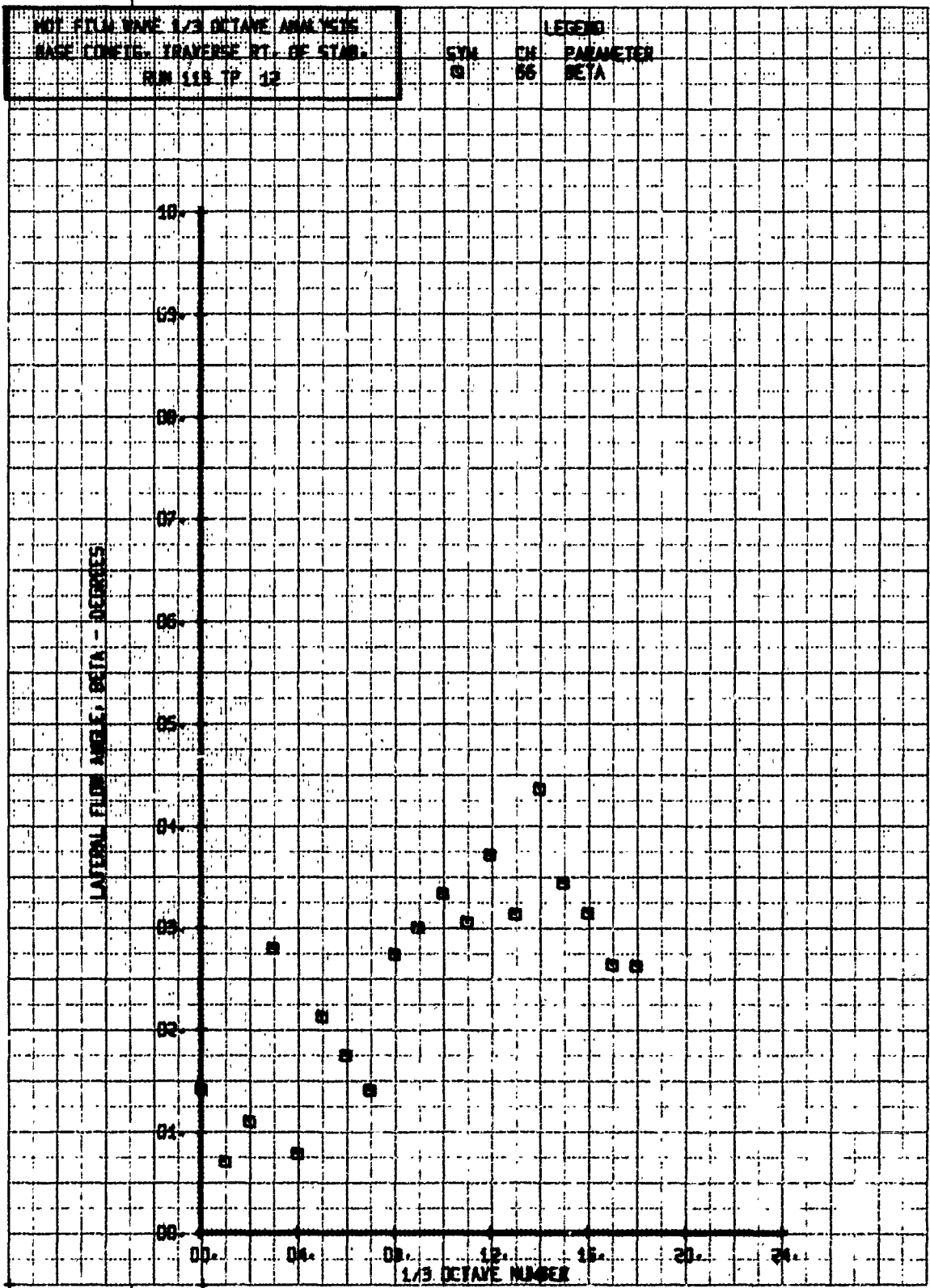


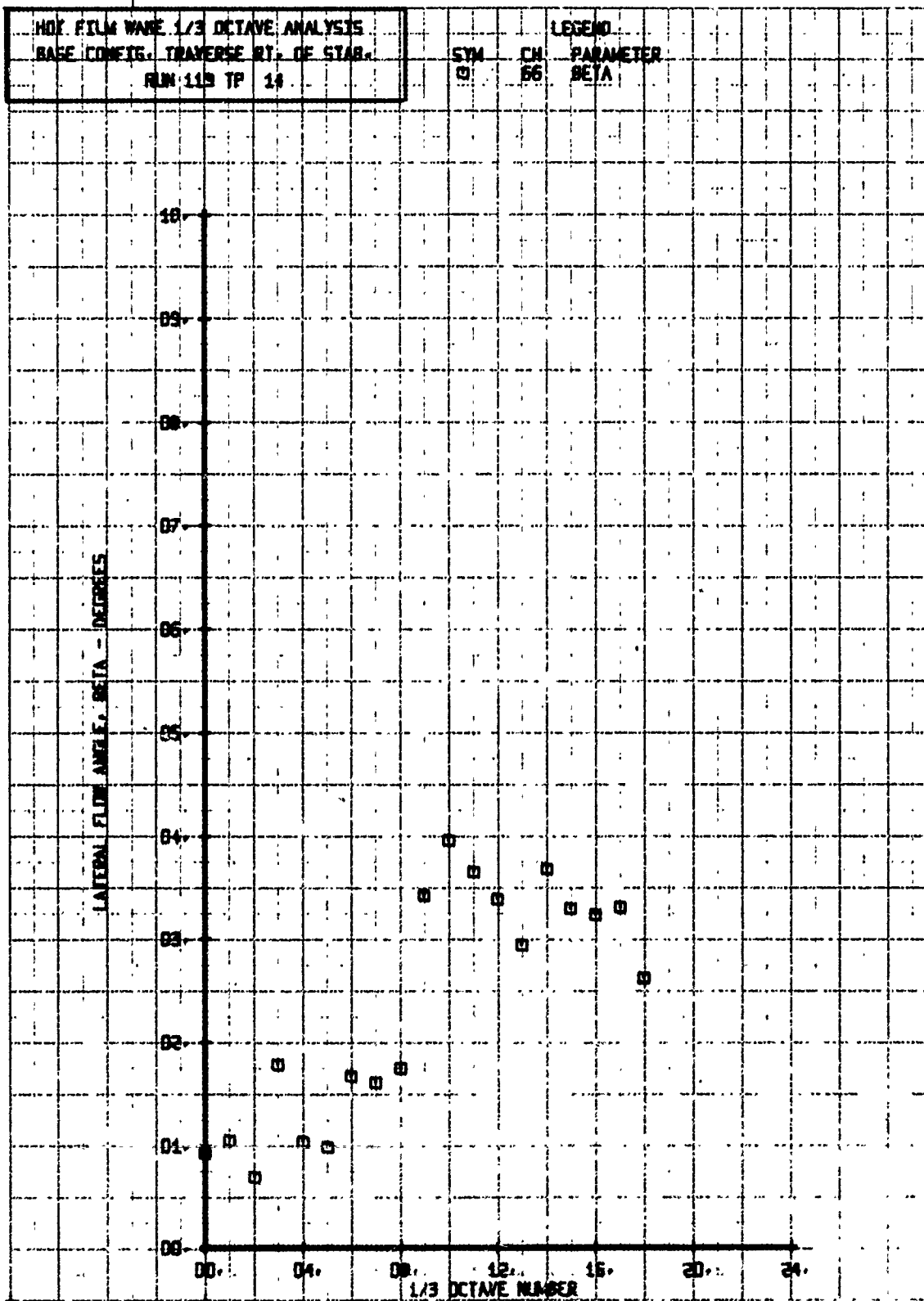










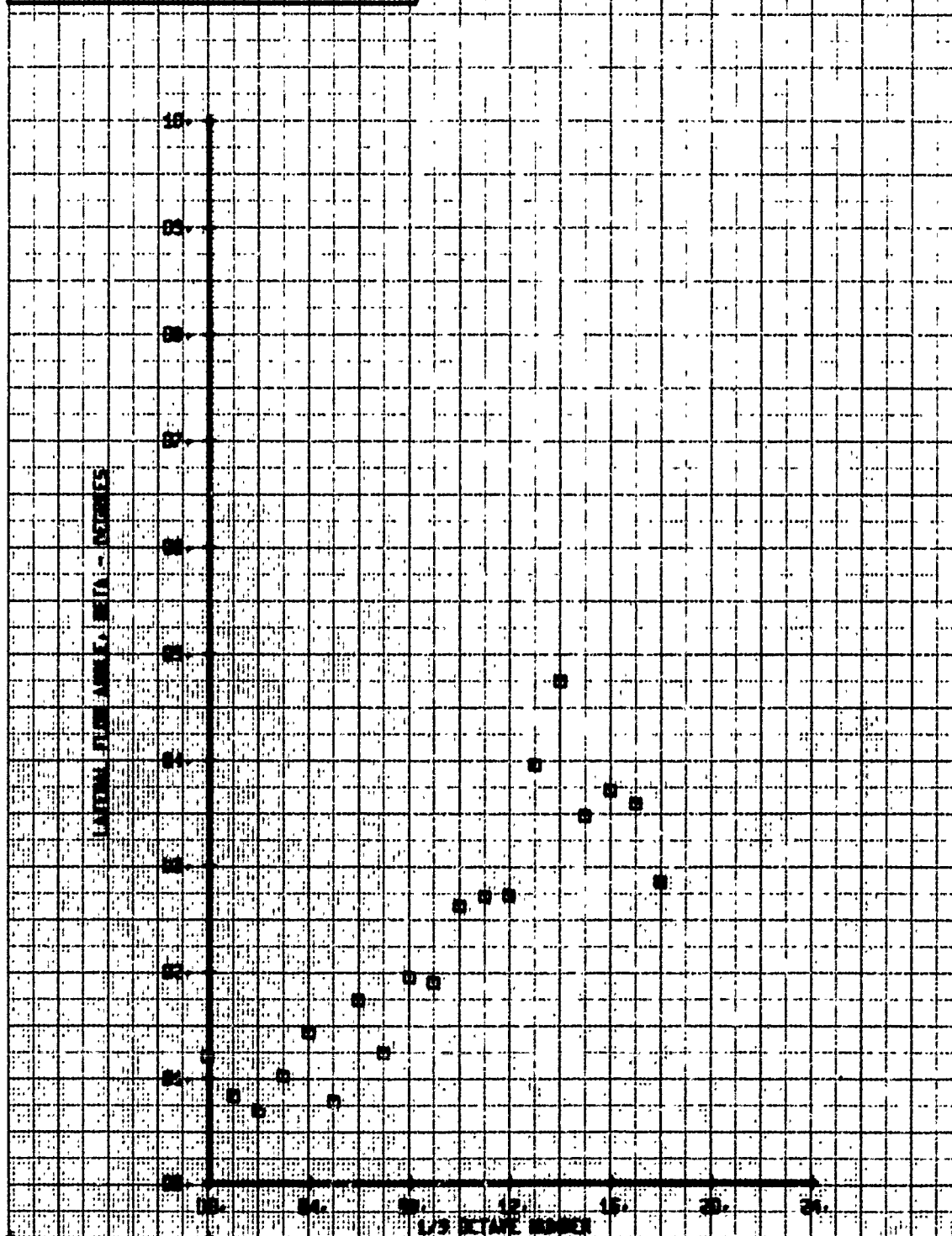


NOY FILM WARE 1/3 OCTAVE ANALYSIS  
 BASE CONFIG. TRAVERSE RT. OF STAB.  
 RUN 119 TP 16

SYM  
 0

CH  
 66

LEGEND  
 PARAMETER  
 BETA



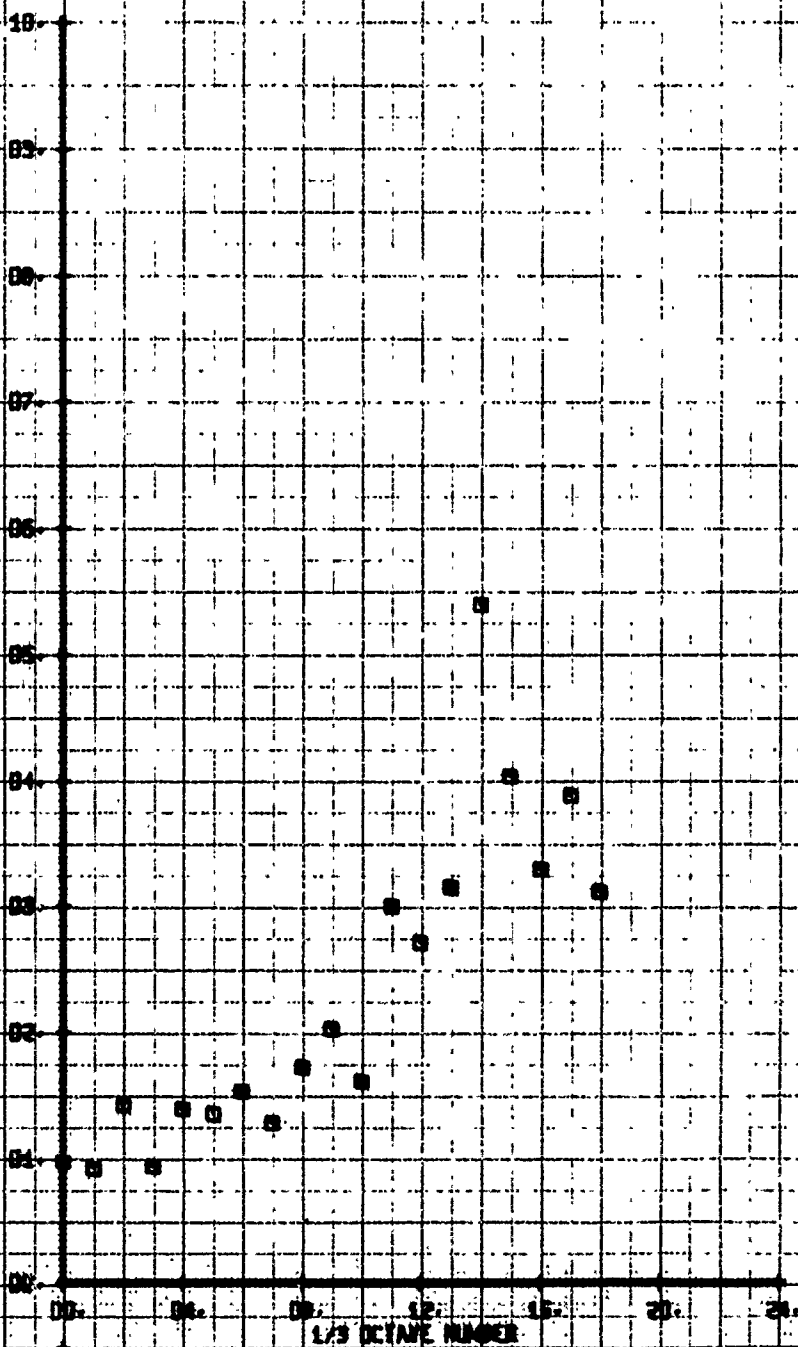
HOT FILM WAKE 1/3 OCTAVE ANALYSIS  
 BASE CONFIG. TRAVERSE RT. DE STAB.  
 RUN 113 TP 20

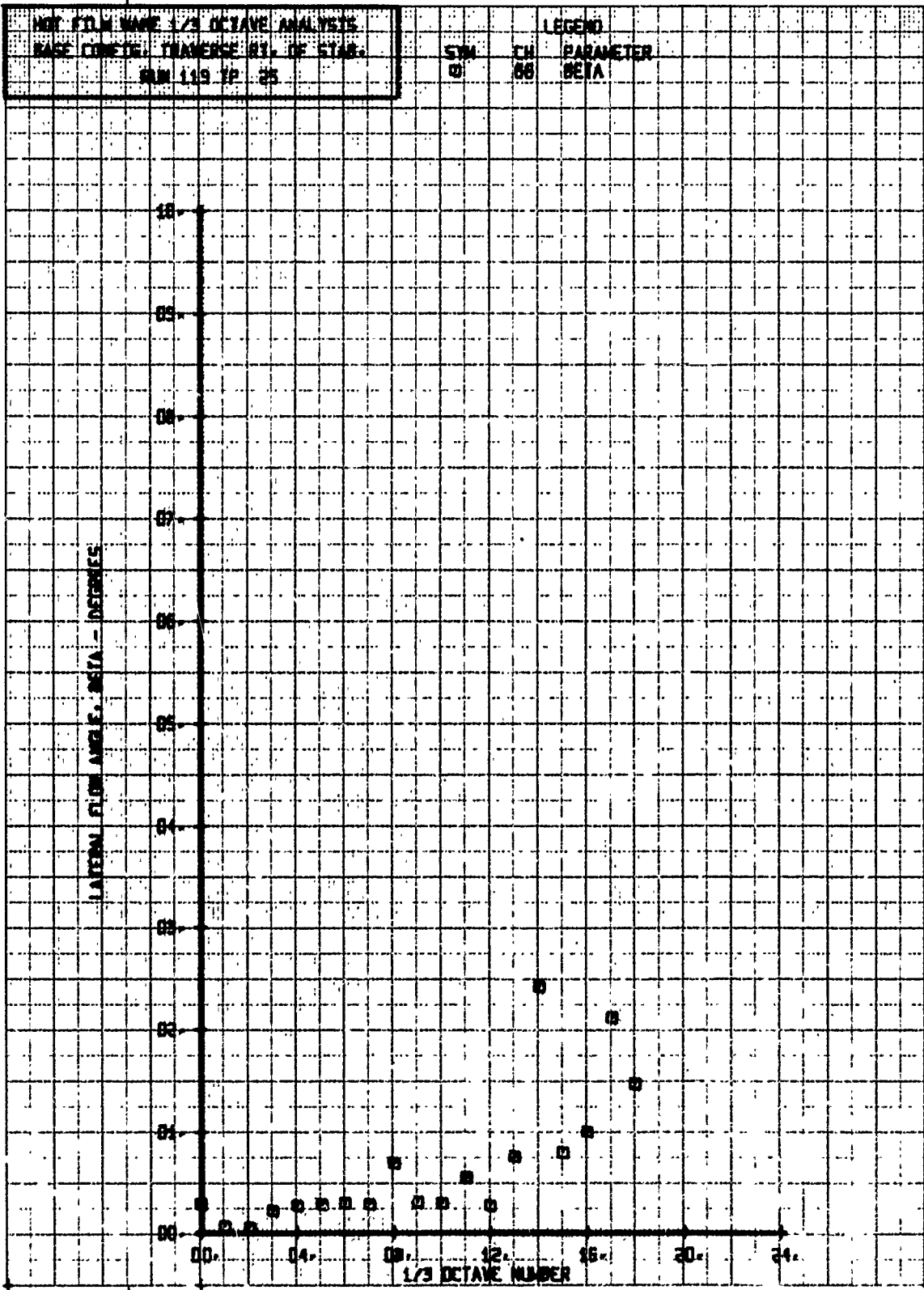
SYM  
 □

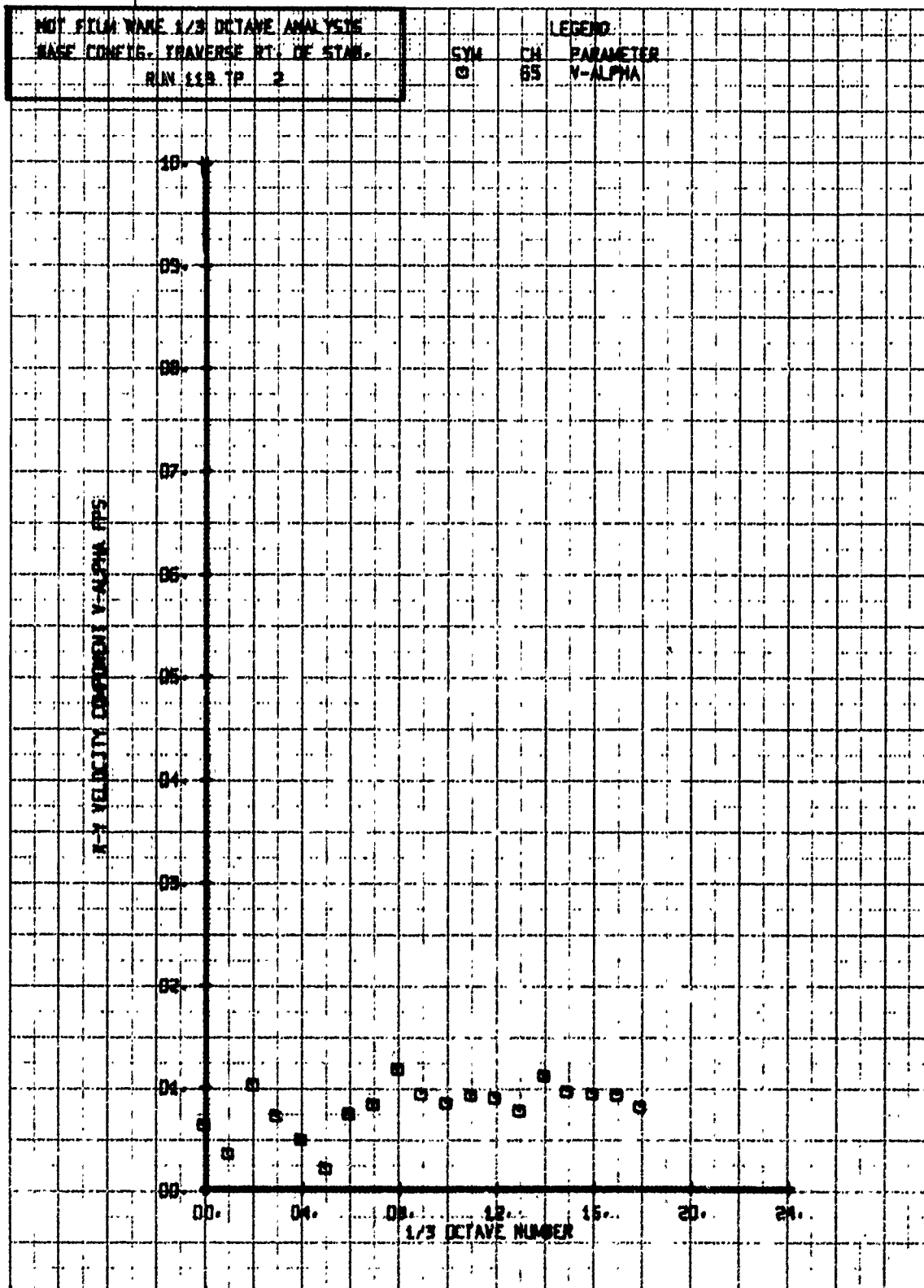
CH.  
 66

LEGEND  
 PARAMETER  
 BETA

LATERAL FLOW ANGLE, BETA - DEGREES

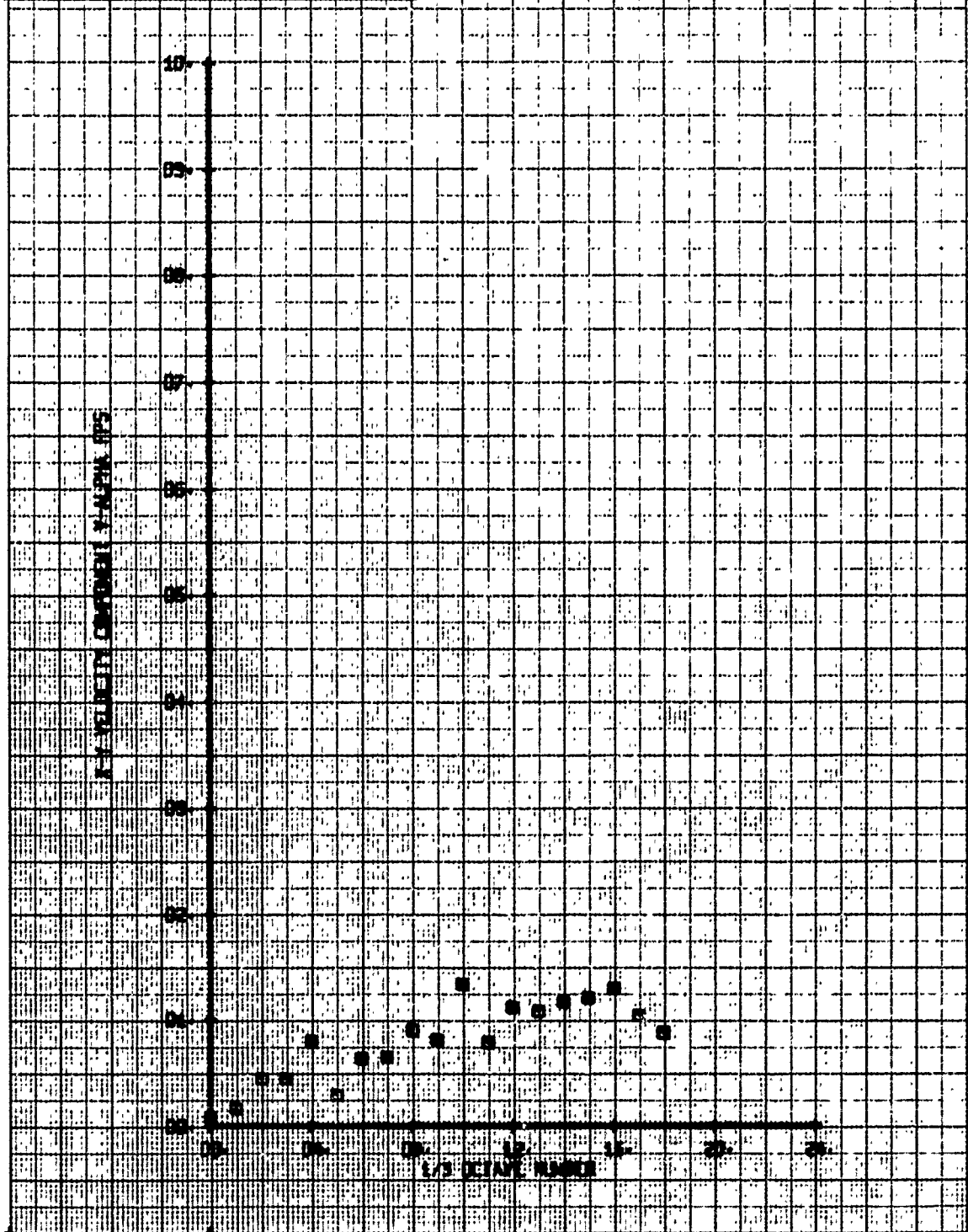






NOT FILM WARE 1/3 OCTAVE ANALYSIS  
 BASE CONFIG. TRAVERSE RT. OF STAR.  
 RUN 113 TP. 5

SYM CH  
 01 65  
 PARAMETER  
 Y-ALPHA





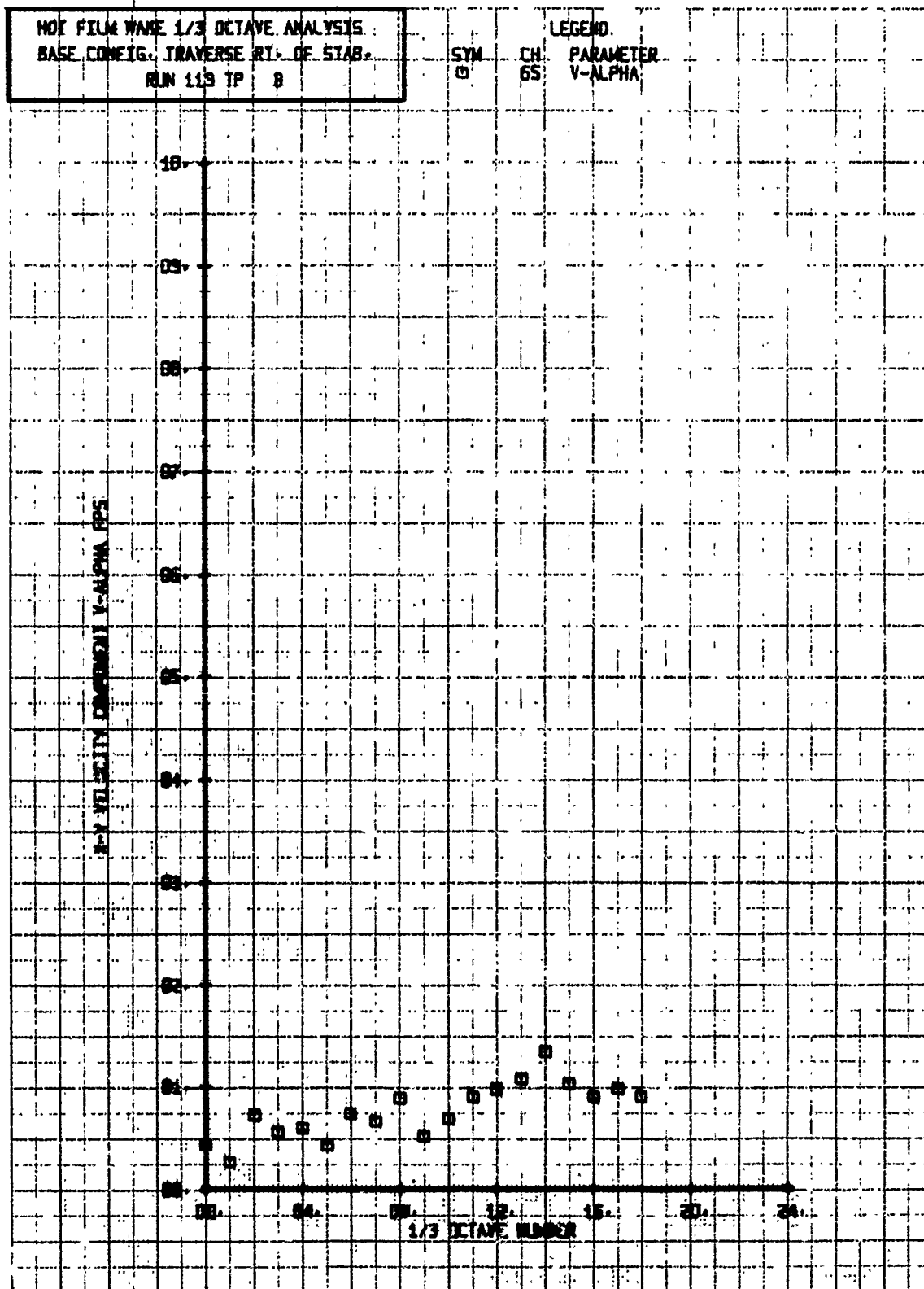
NOI FILM WAVE 1/3 OCTAVE ANALYSIS  
 BASE CONFIG. TRAVERSE RT. OF STAB.  
 RUN 119 TP 8

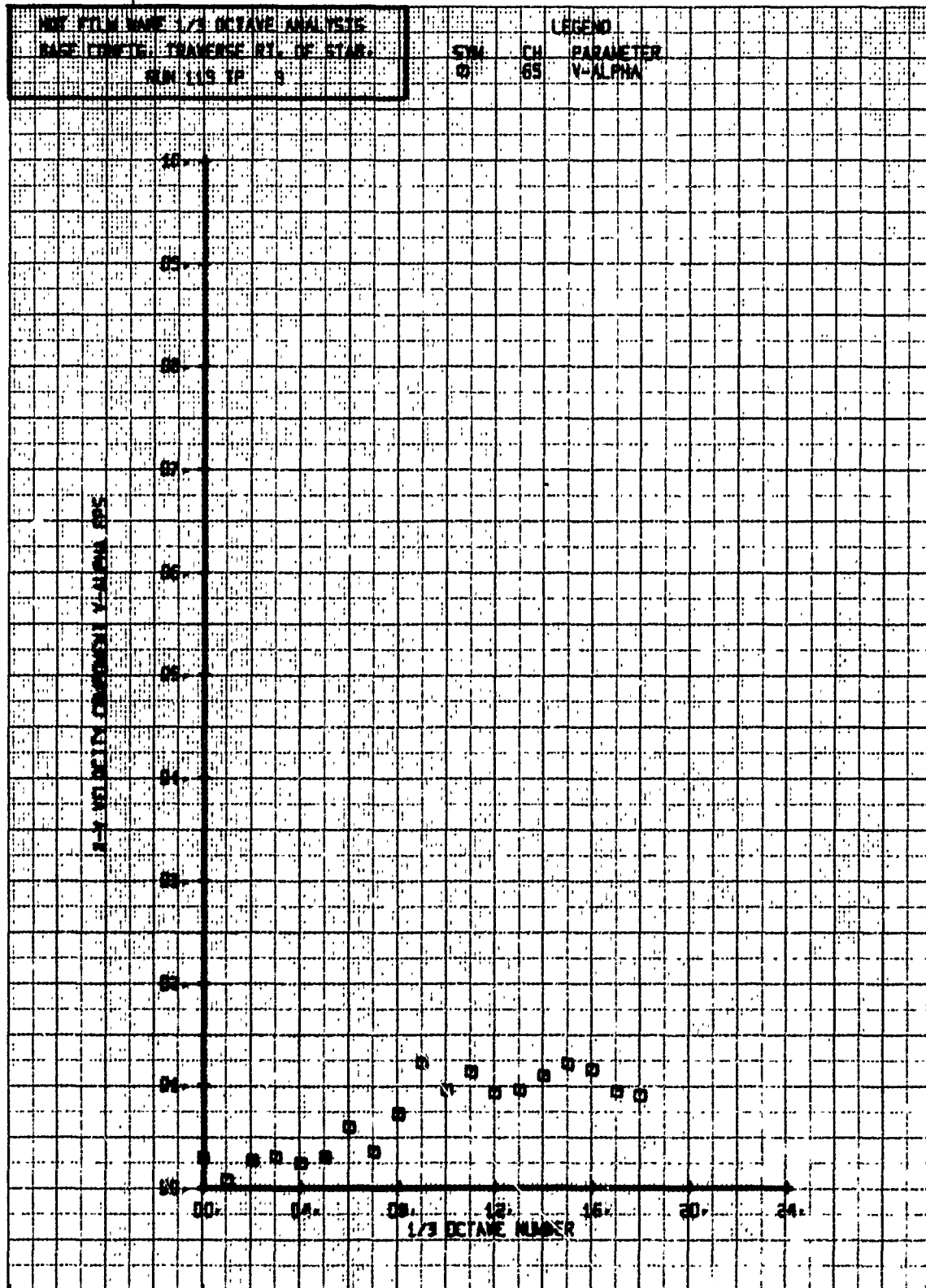
SYM  
 0

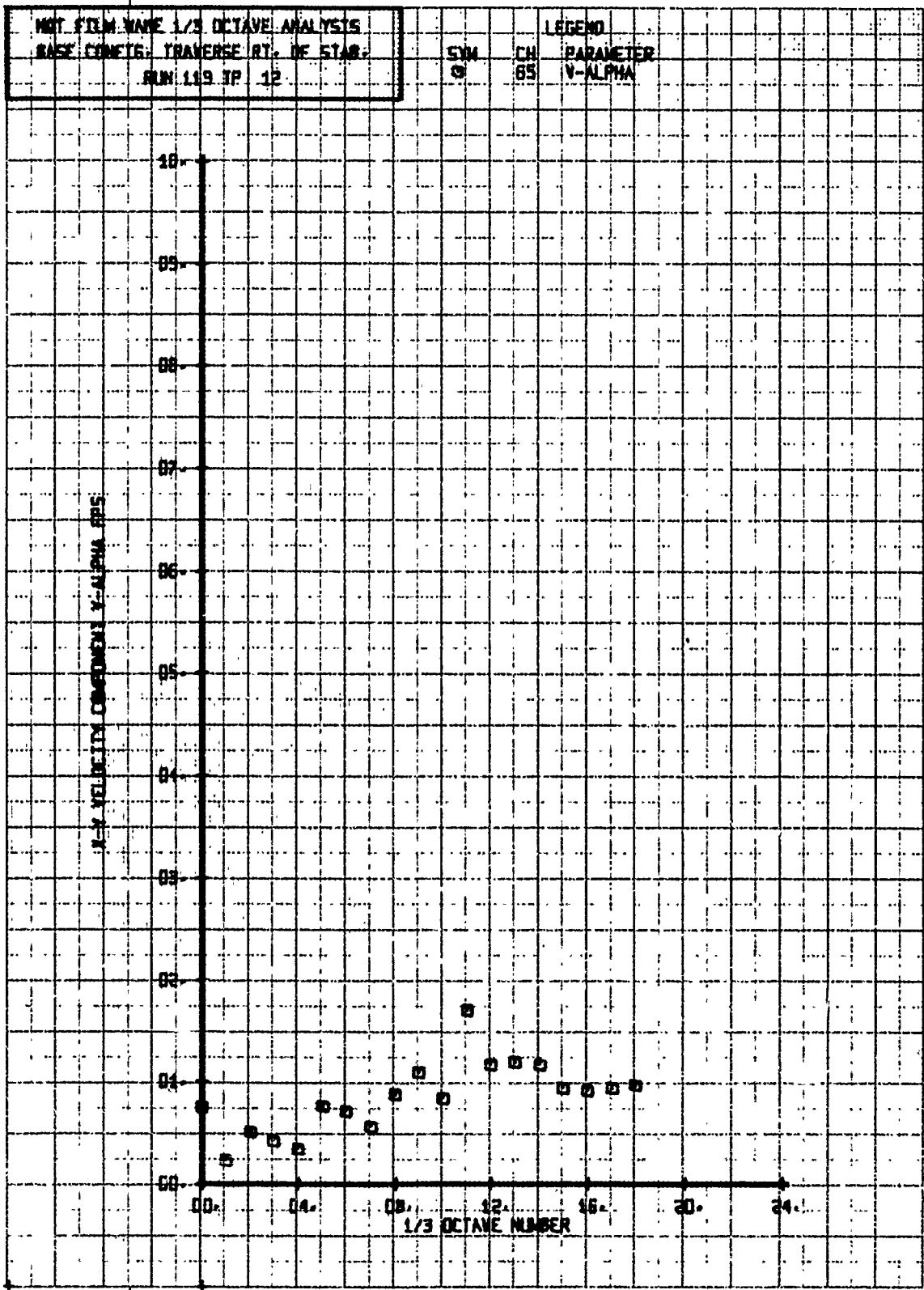
CH  
 65

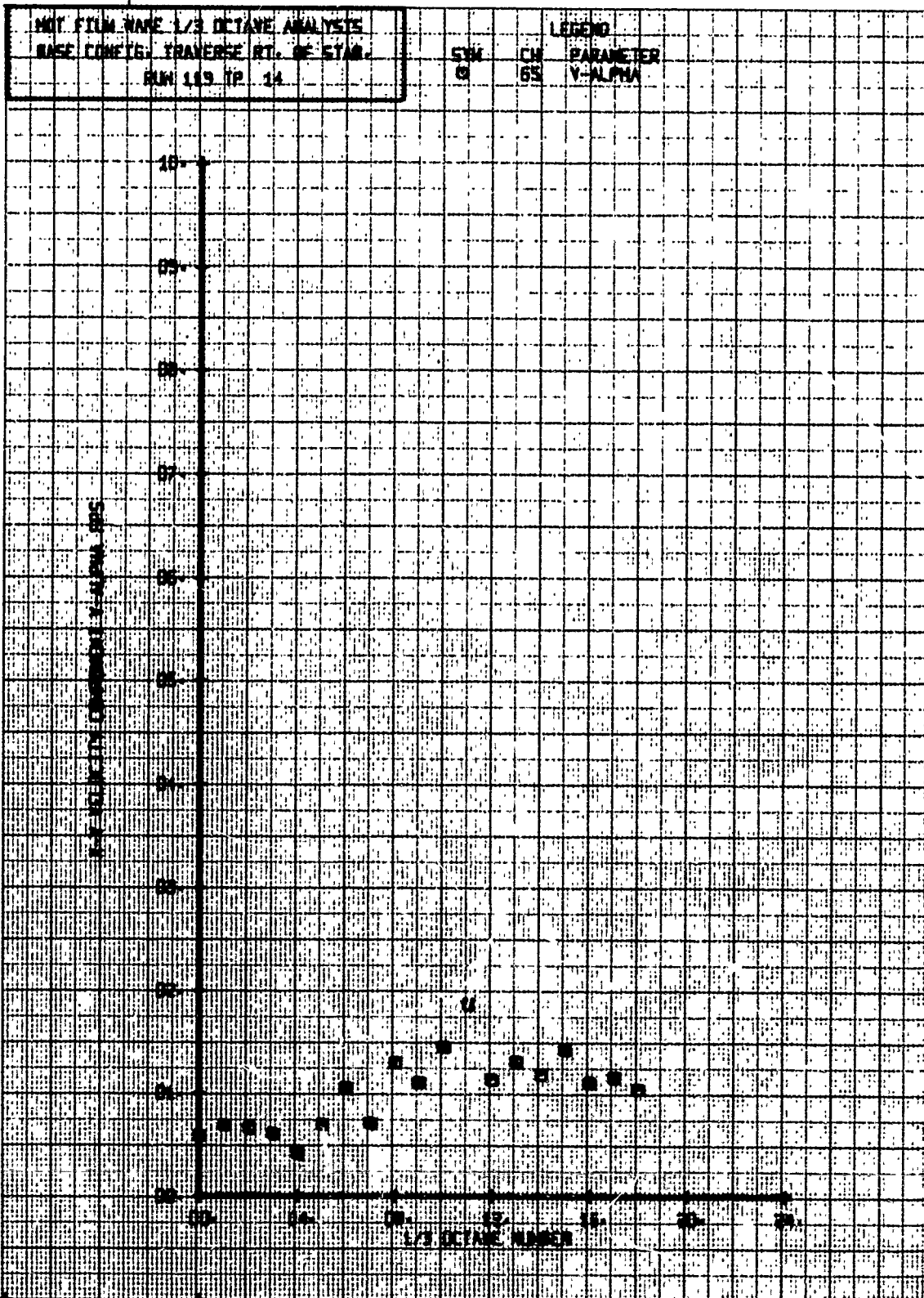
LEGEND.  
 PARAMETER  
 V-ALPHA

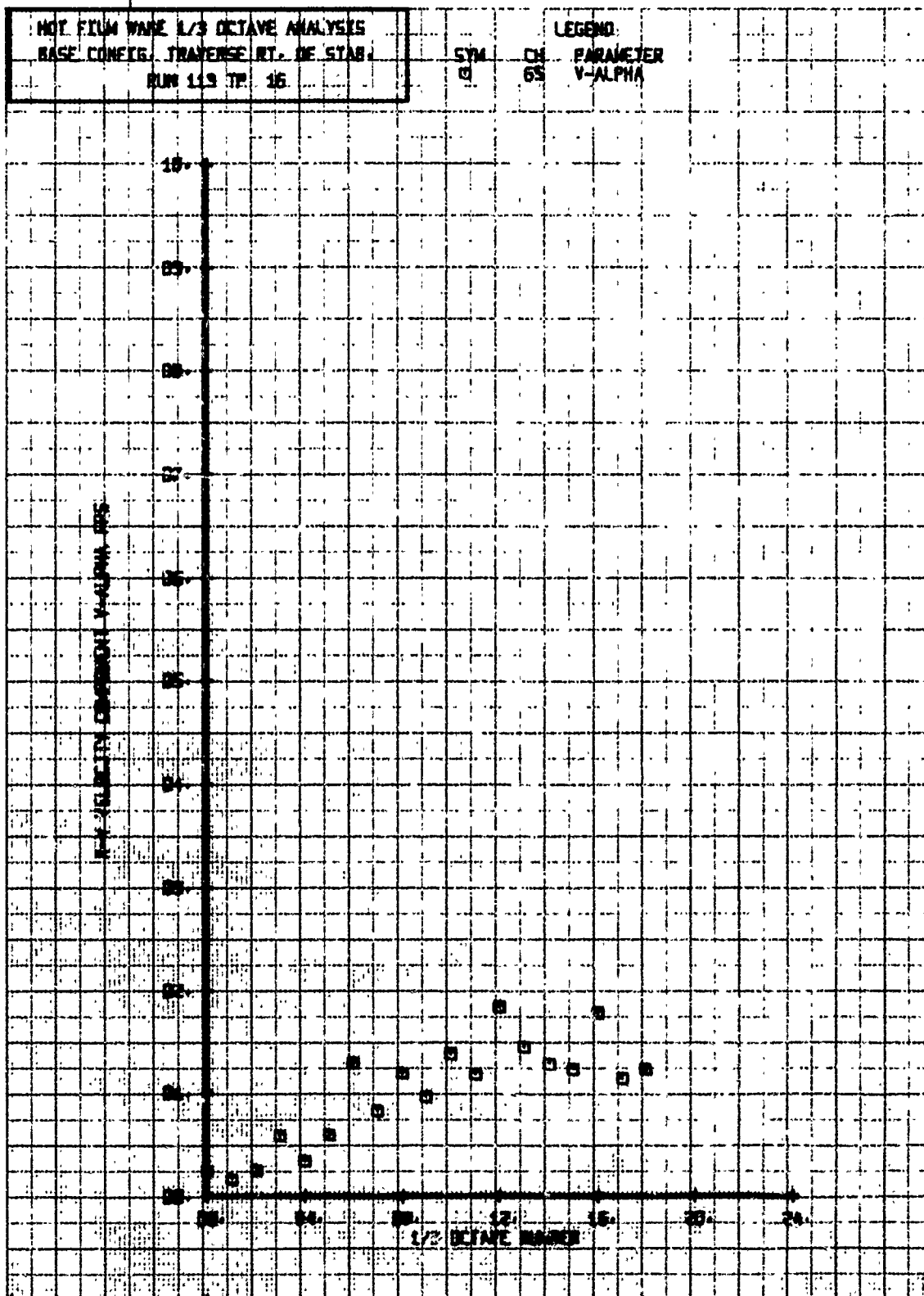
A-Y VELOCITY DEPENDENT V-ALPHA EPS

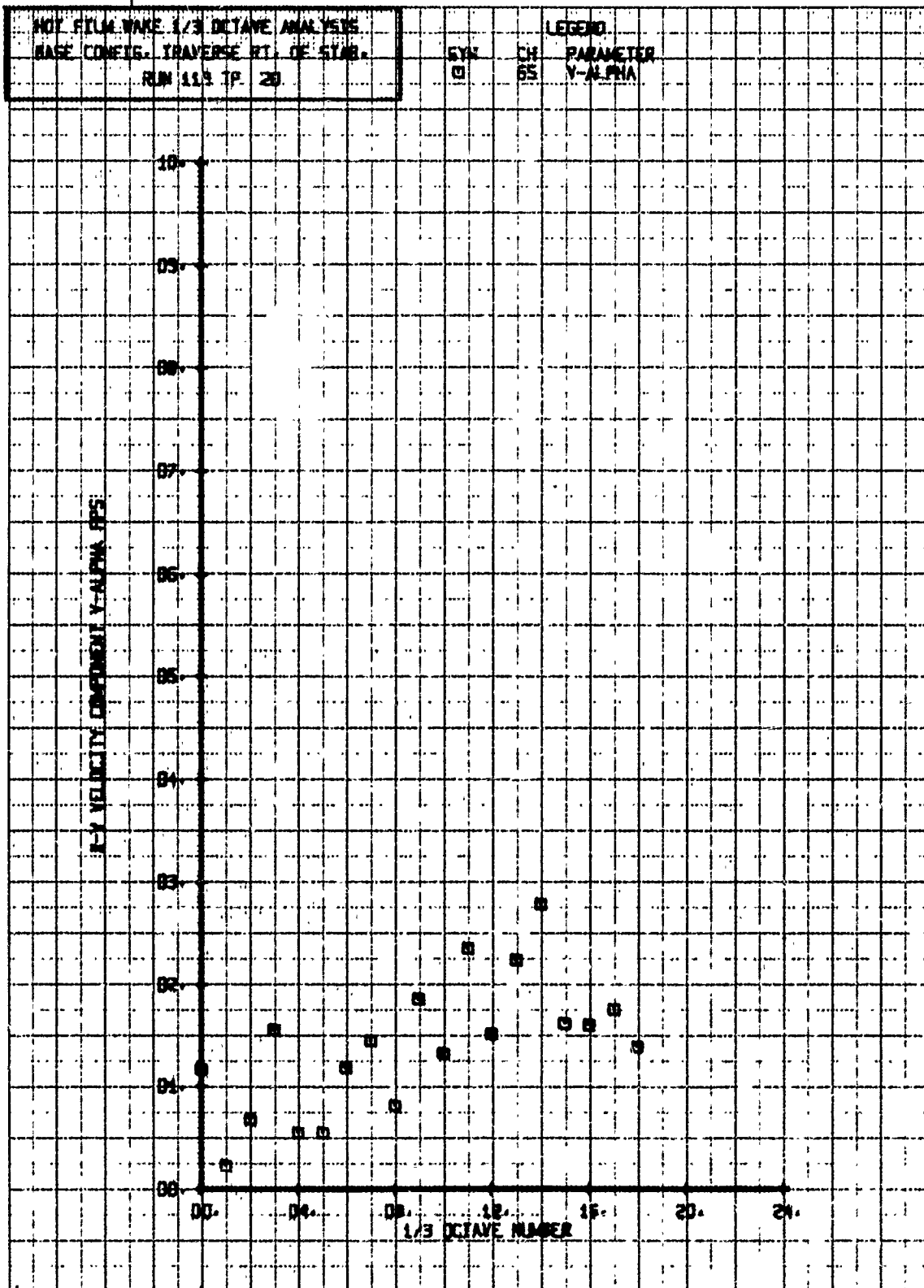


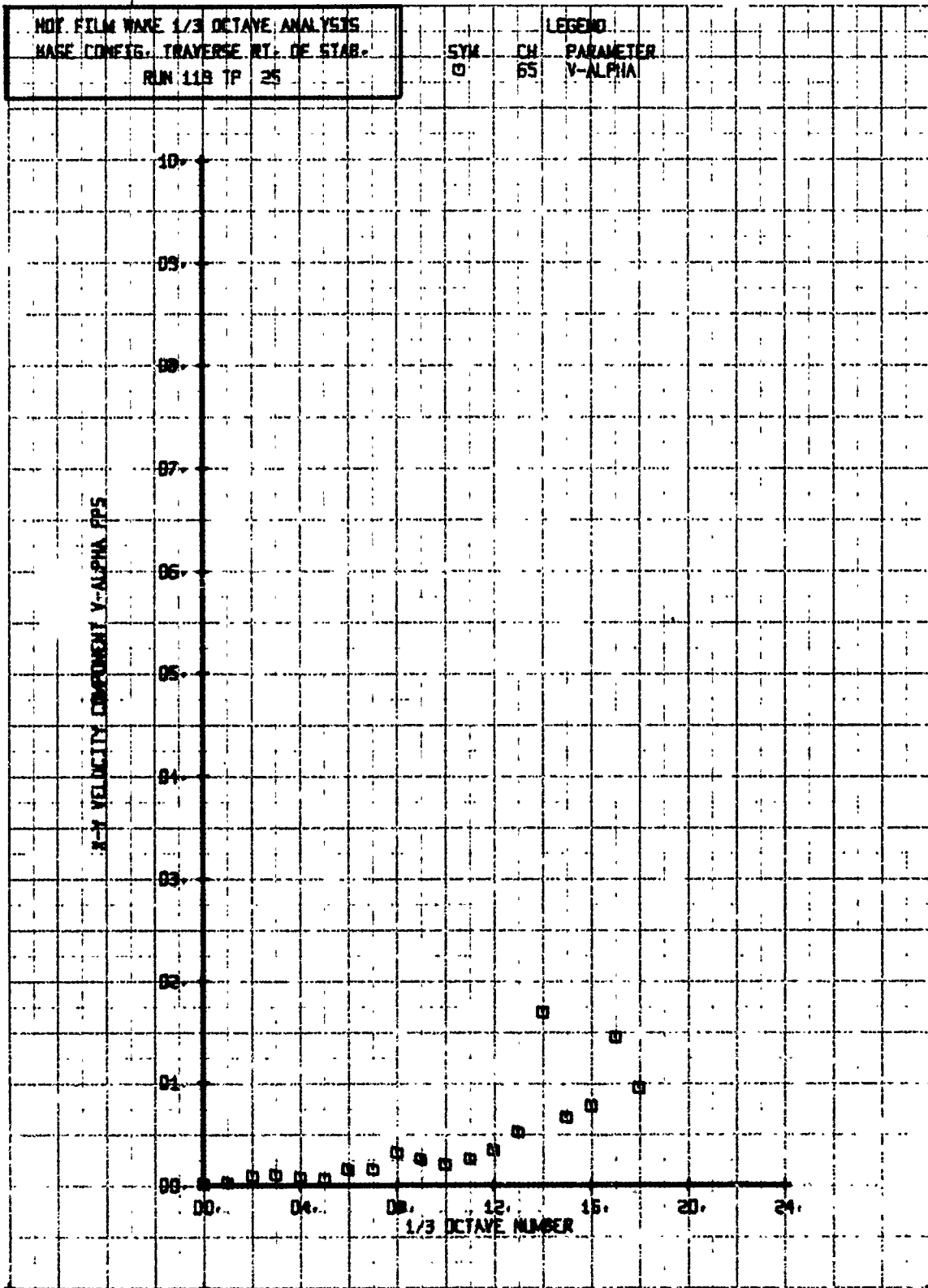






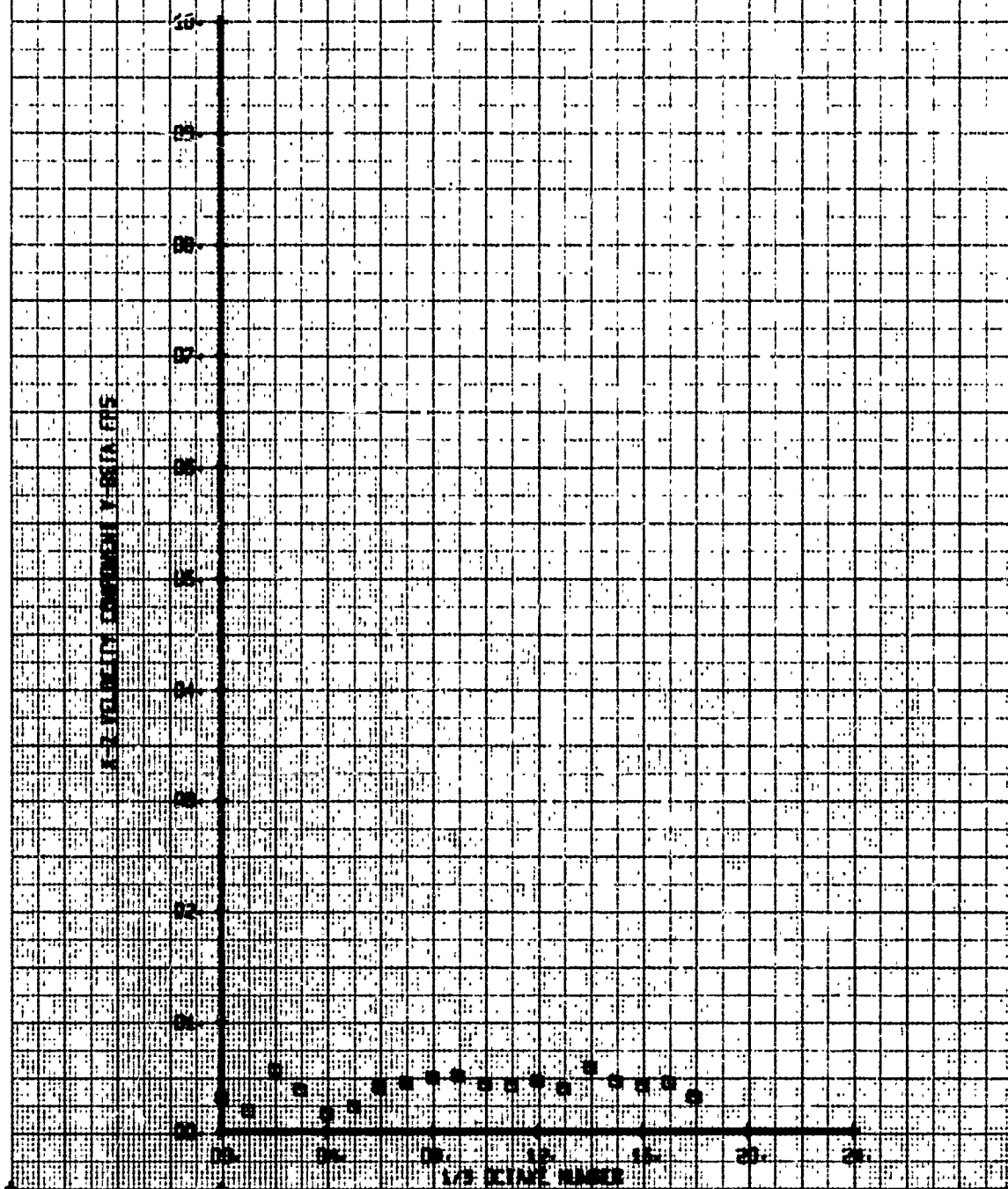






HOT FILM WAKE 1/3 OCTAVE ANALYSIS  
 BASE CONFIG. TRAVERSE RT. OF STAR.  
 RUN 118 TP 2

| SYM | CH | PARAMETER |
|-----|----|-----------|
| Q   | 56 | V-BETA    |





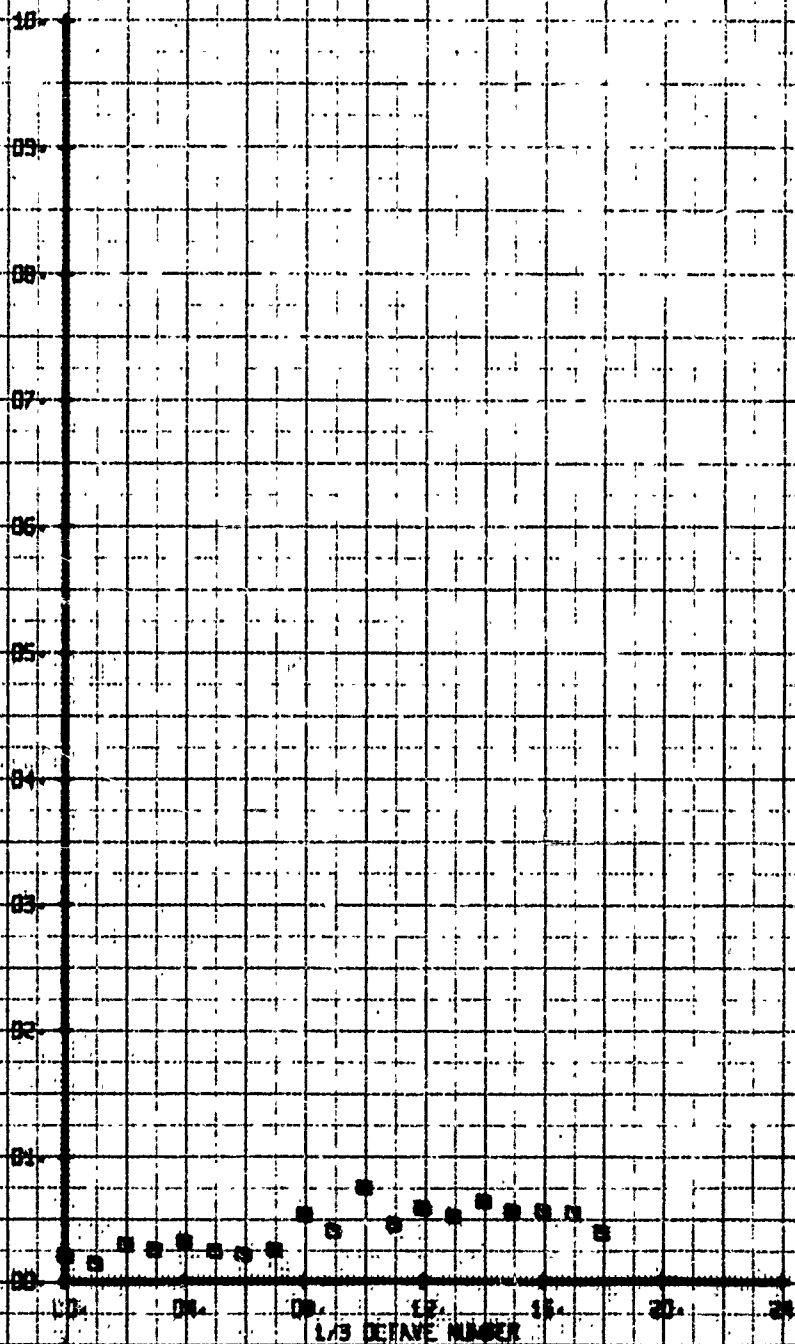
HOT FILM WAKE 1/3 OCTAVE ANALYSIS  
 BASE CONFIG. TRAVERSE RT. OF STAB.  
 RUN 113 TP 5

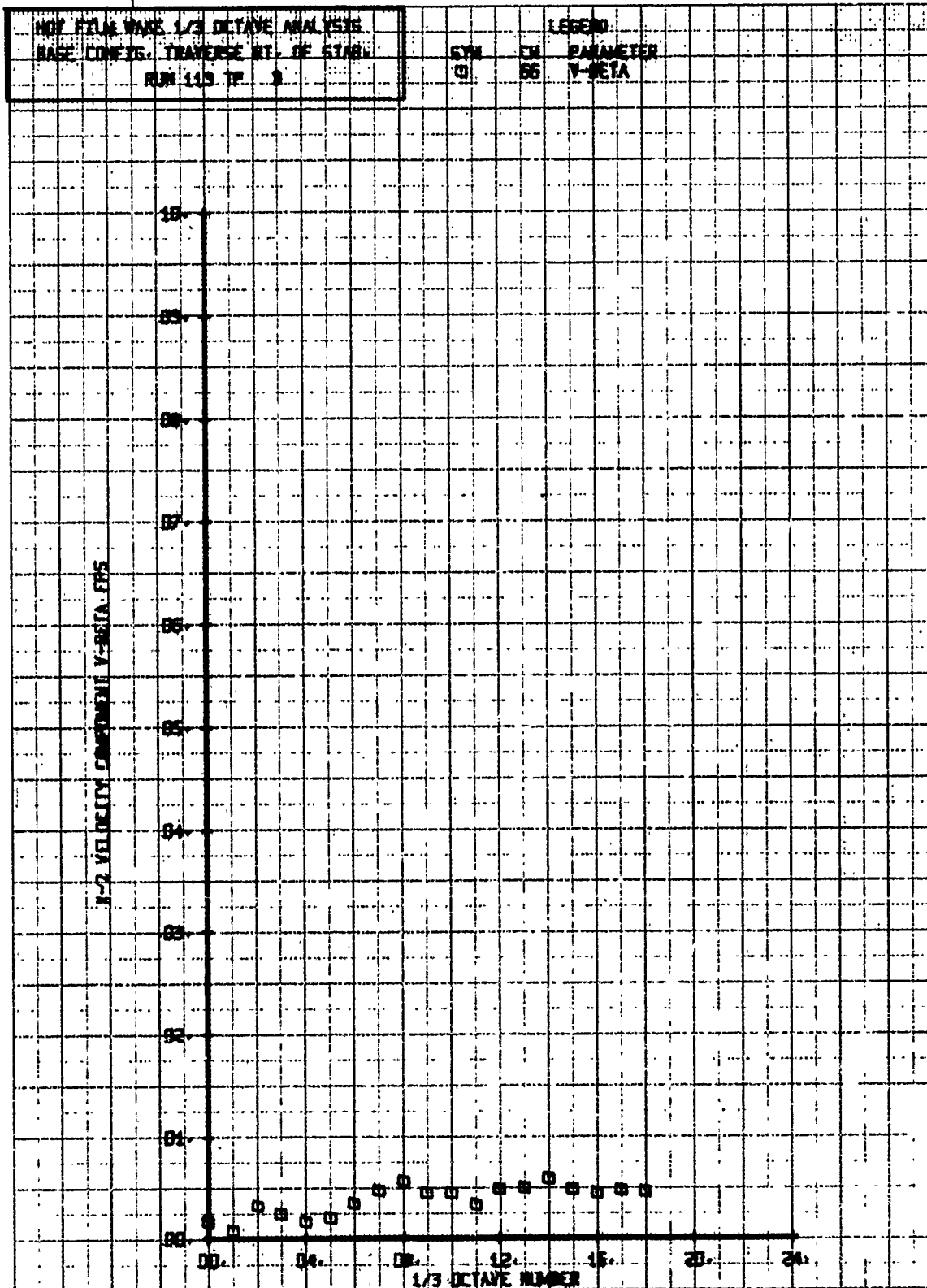
SYM  
 □

CH  
 66

LEGEND  
 PARAMETER  
 V-BETA

IN-2 VELOCITY COMPONENT V-BETA FPS

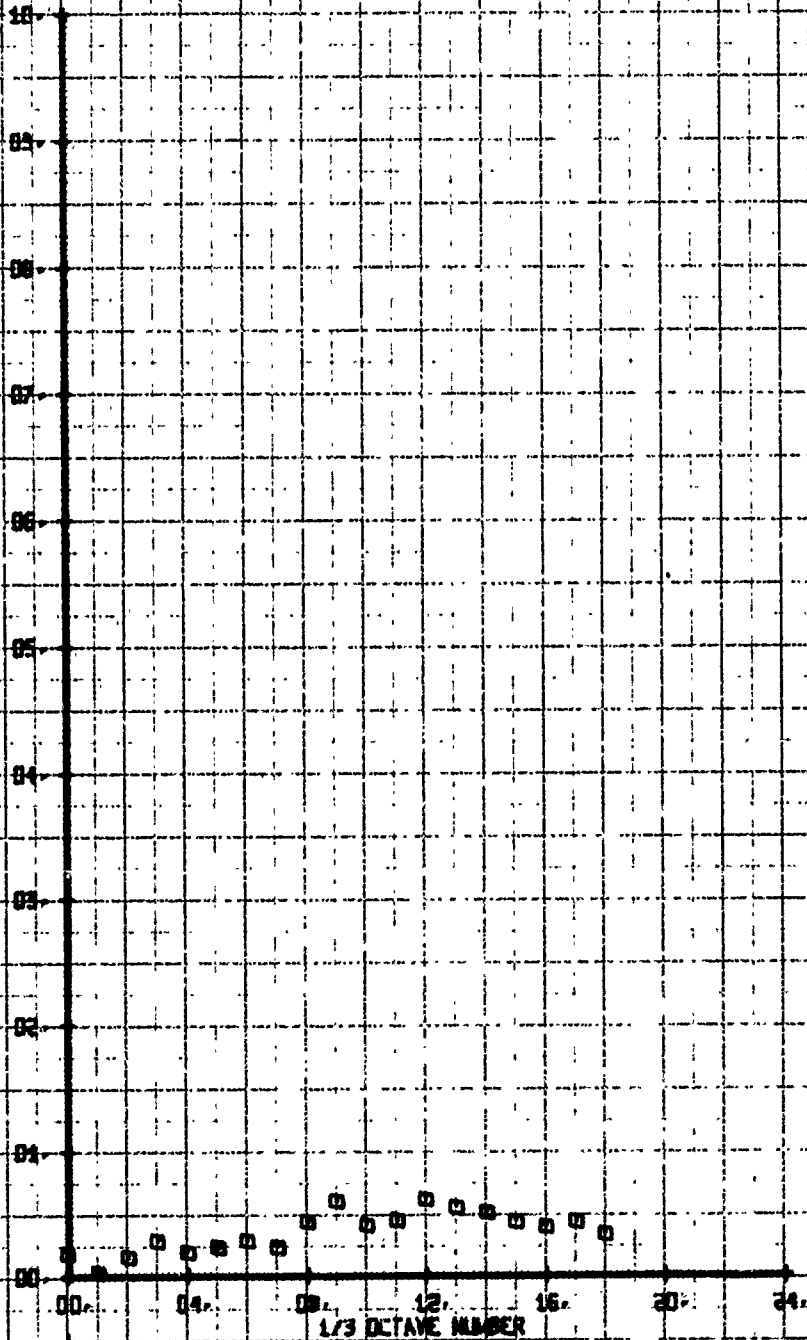


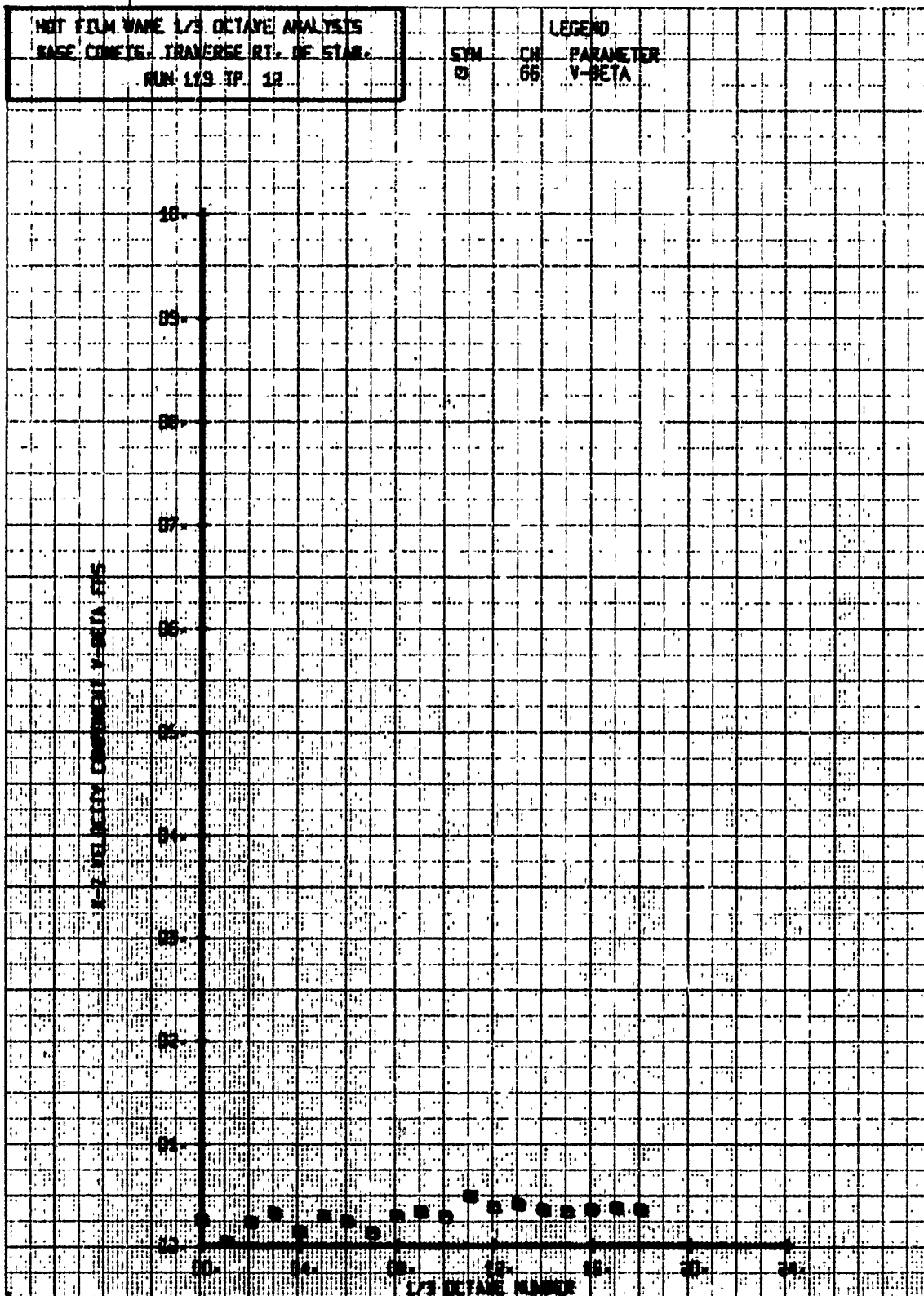


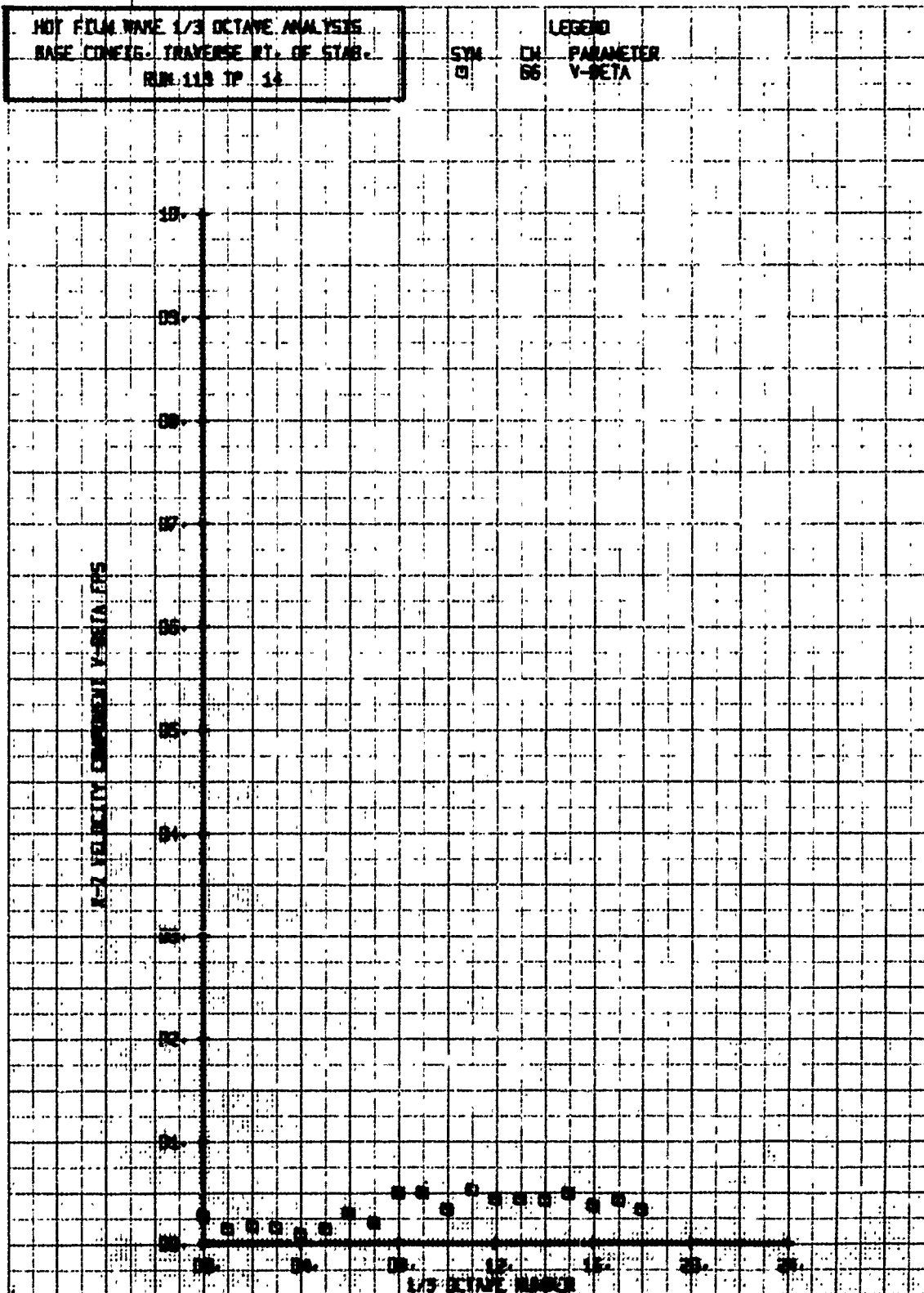
NOT FILM WAVE 1/3 OCTAVE ANALYSIS  
 BASE POINTS, TRANSVERSE RT. OF STAB.  
 RUN 119 IP 3

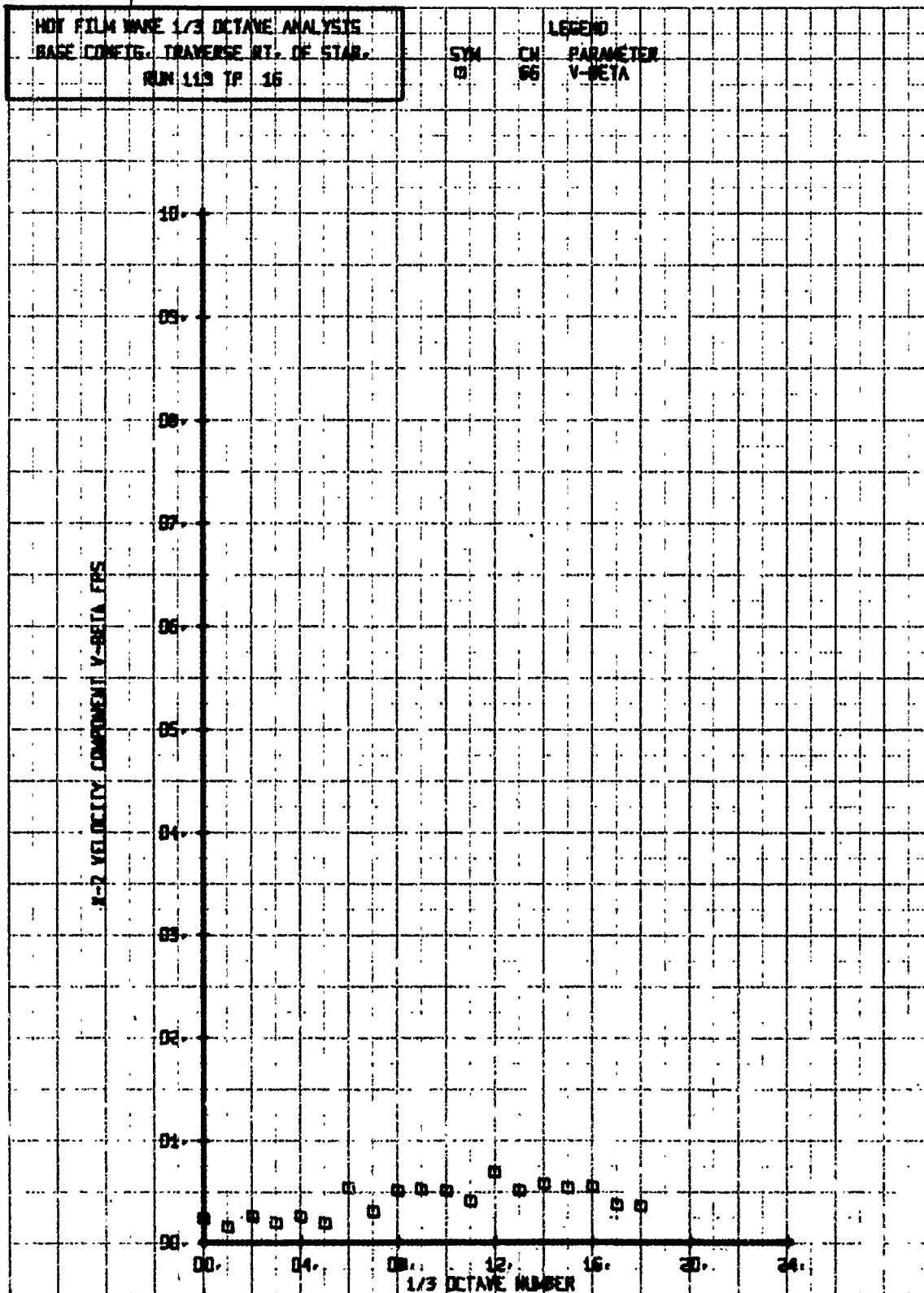
SYN CH  
 0 66  
 PARAMETER  
 V-BETA

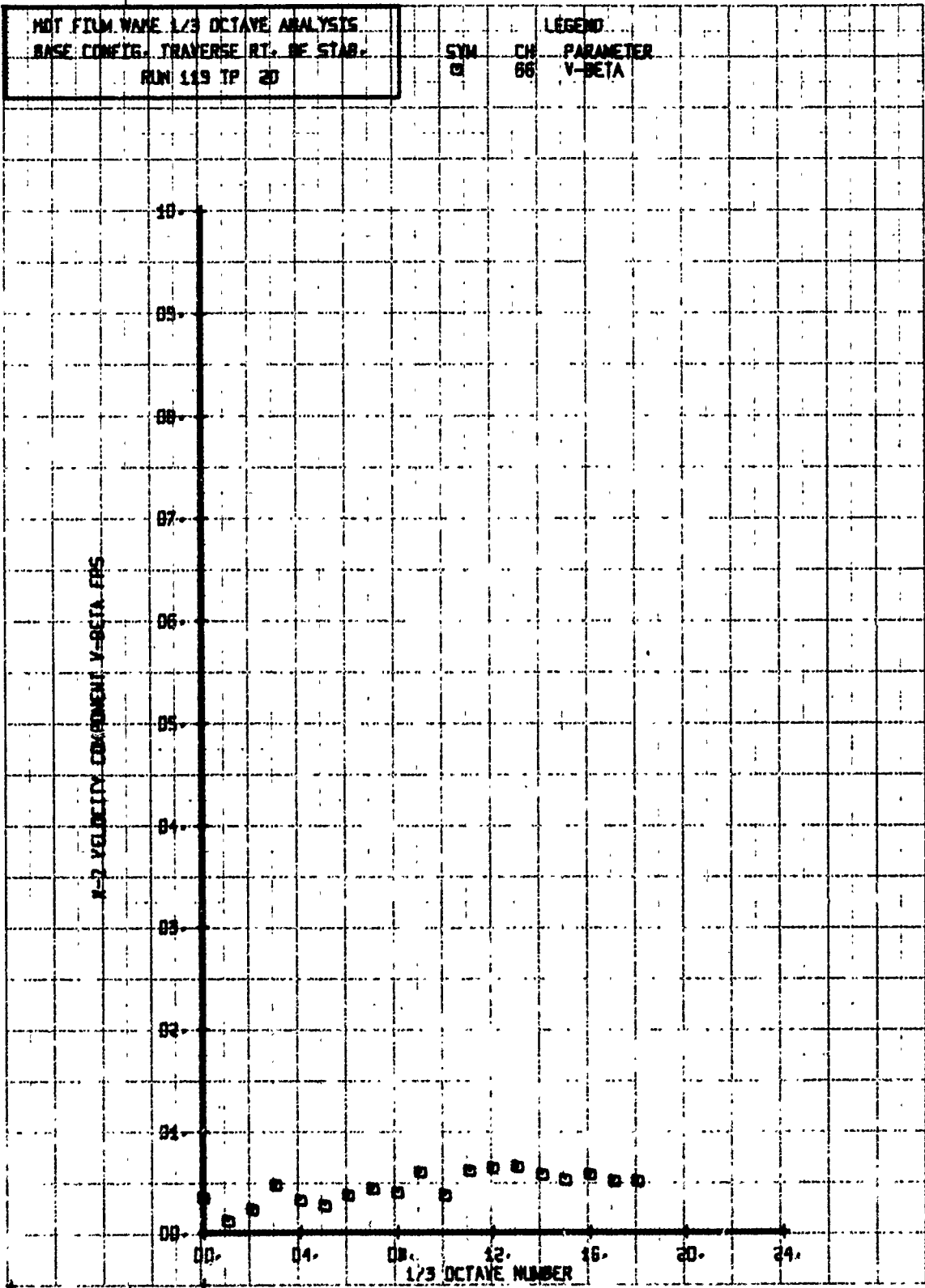
1-2 VELOCITY COMPONENT V-BETA RMS

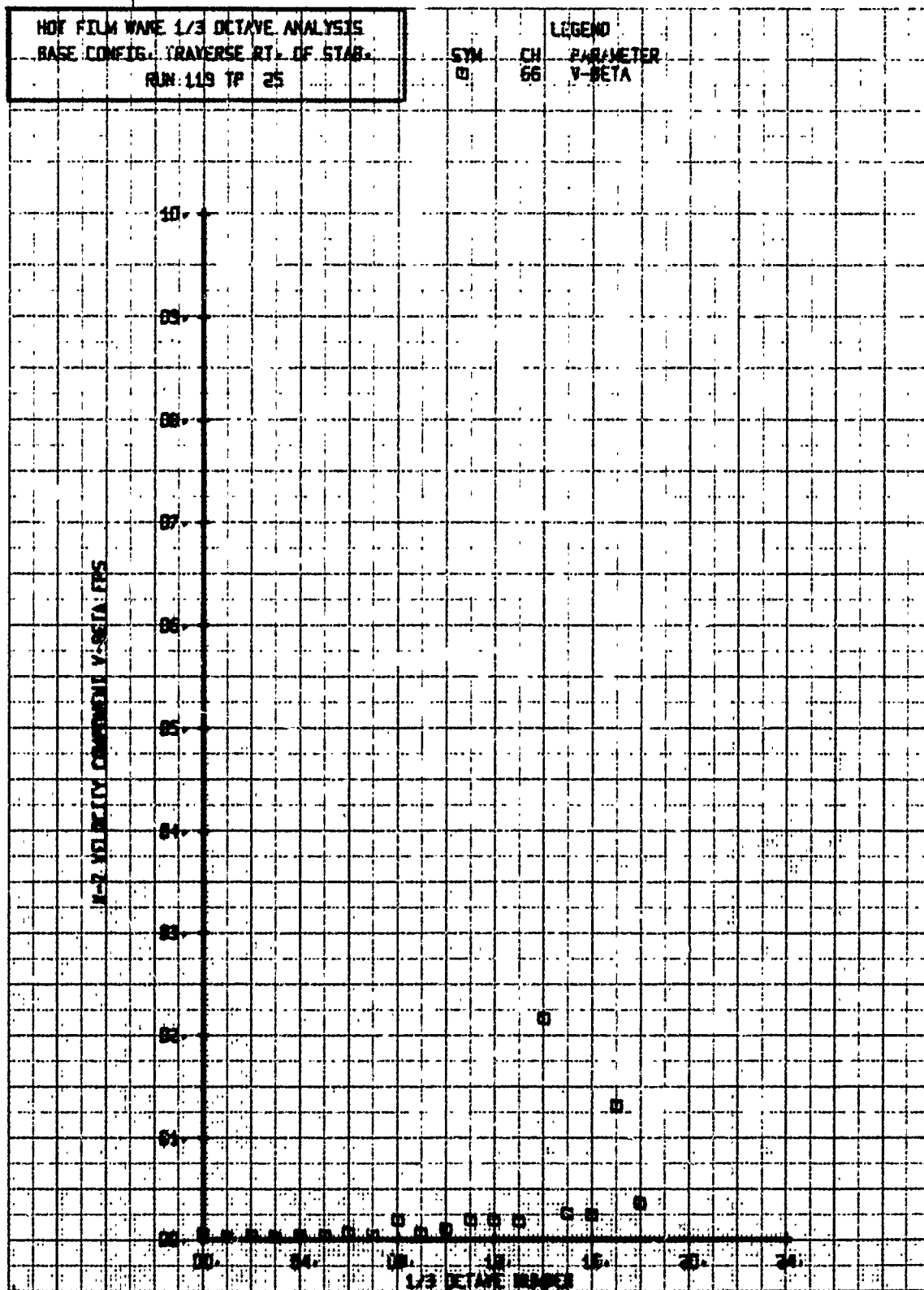












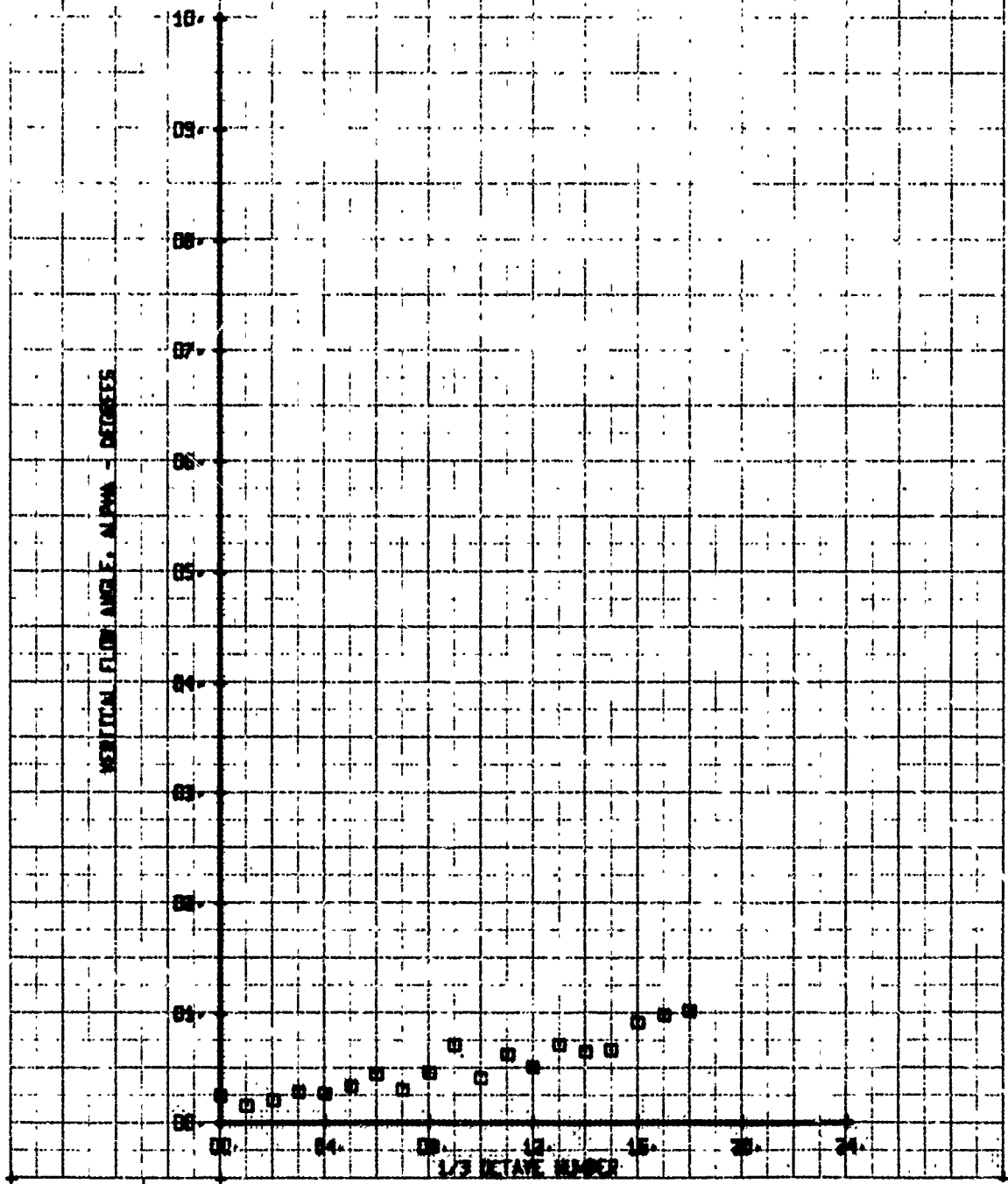


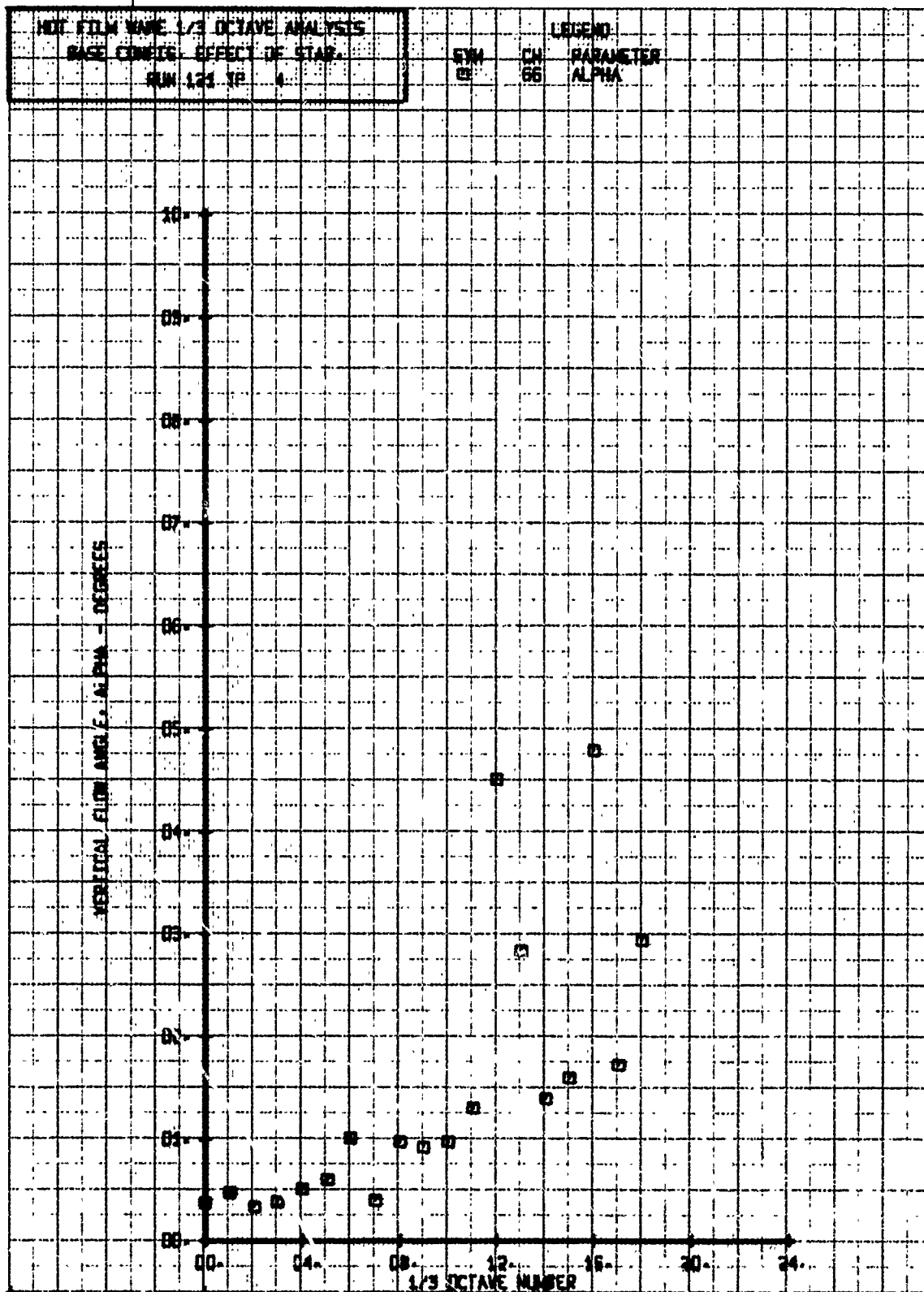
HOT FILM WAKE 1/3 OCTAVE ANALYSIS  
 BASE CORRIS. EFFECT OF STAB.  
 RUN 121 TP 3

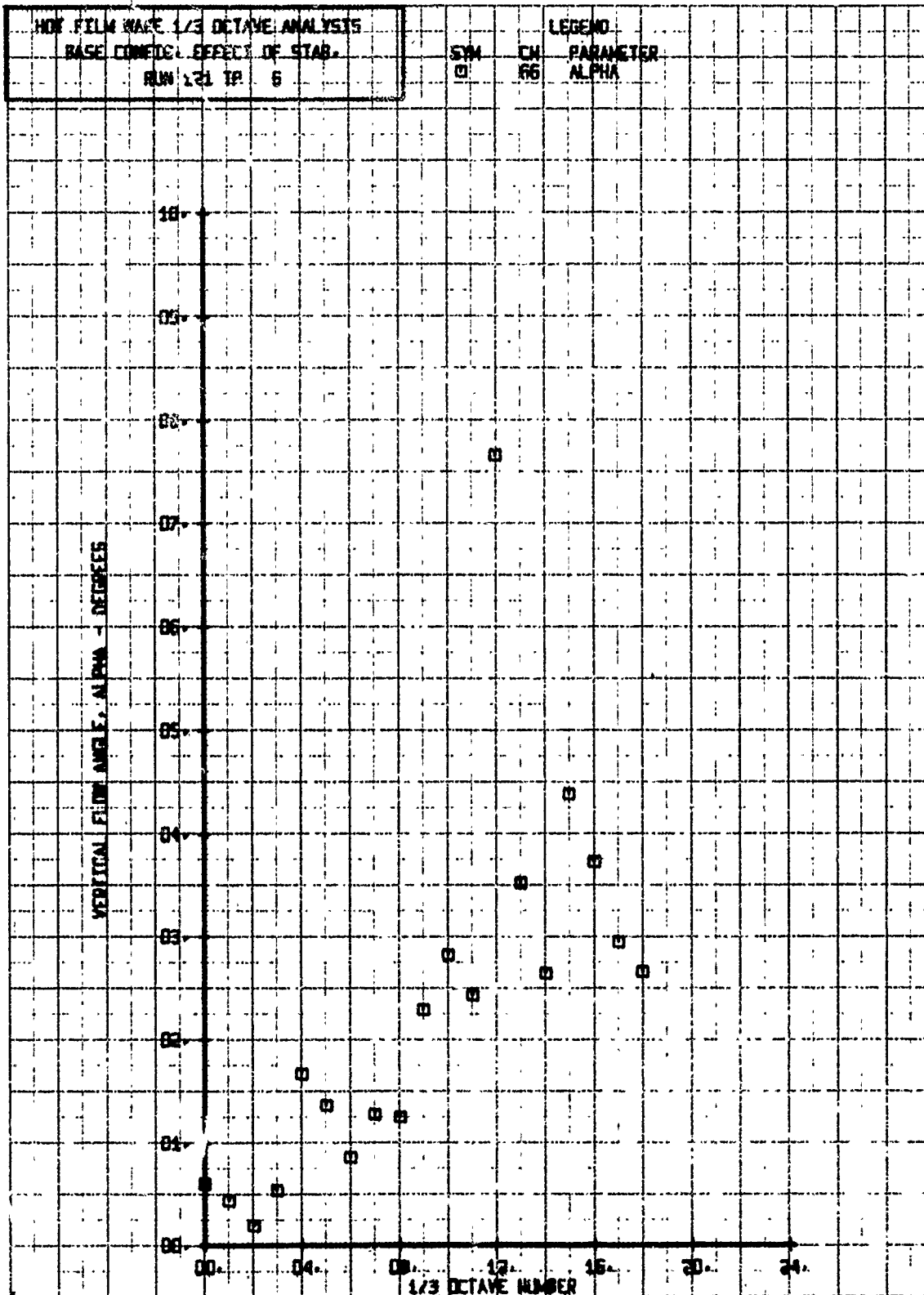
CH  
 65

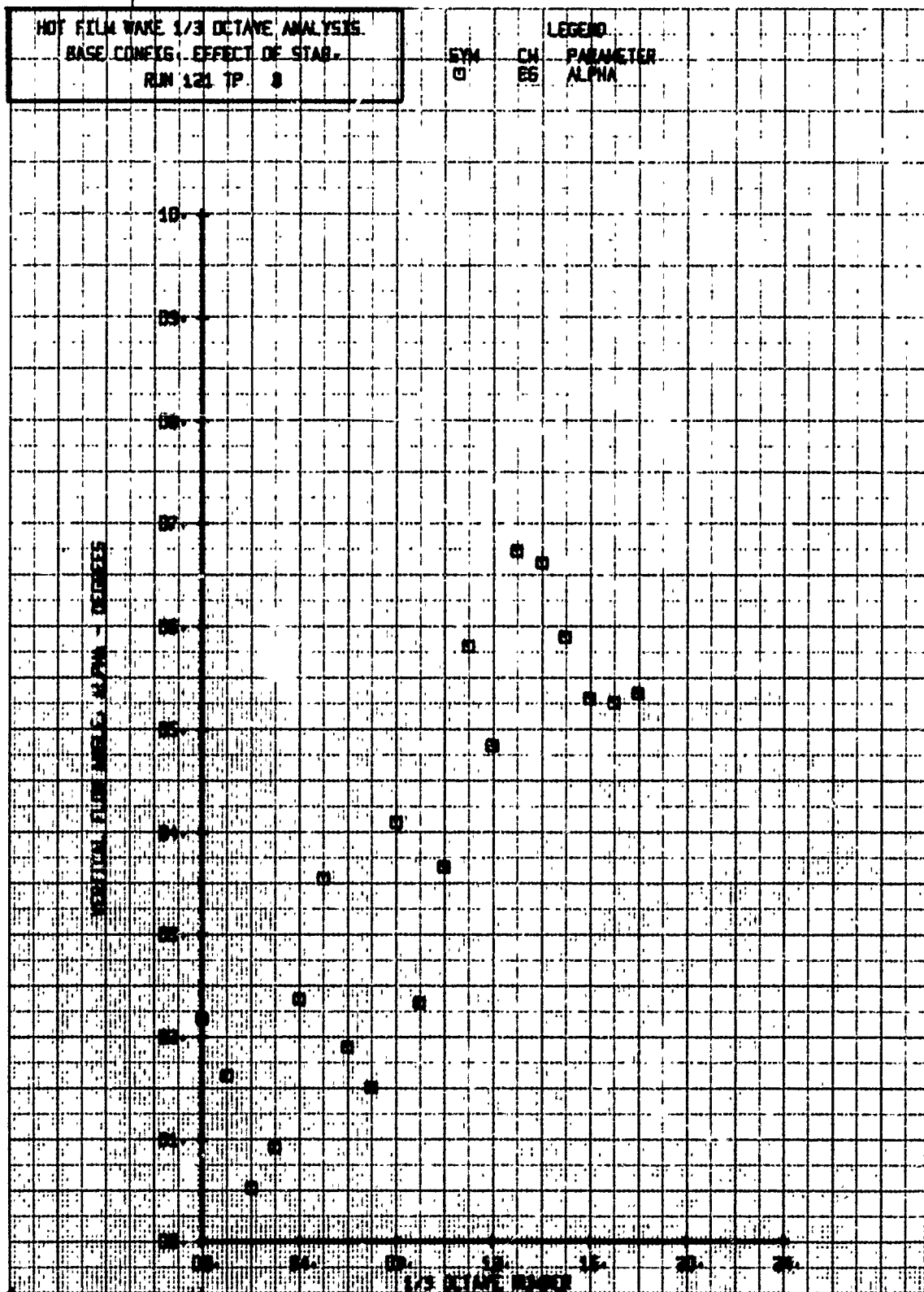
LEGEND  
 PARAMETER  
 ALPHA

HORIZONTAL FILM ANGLE, ALPHA - DEGREES







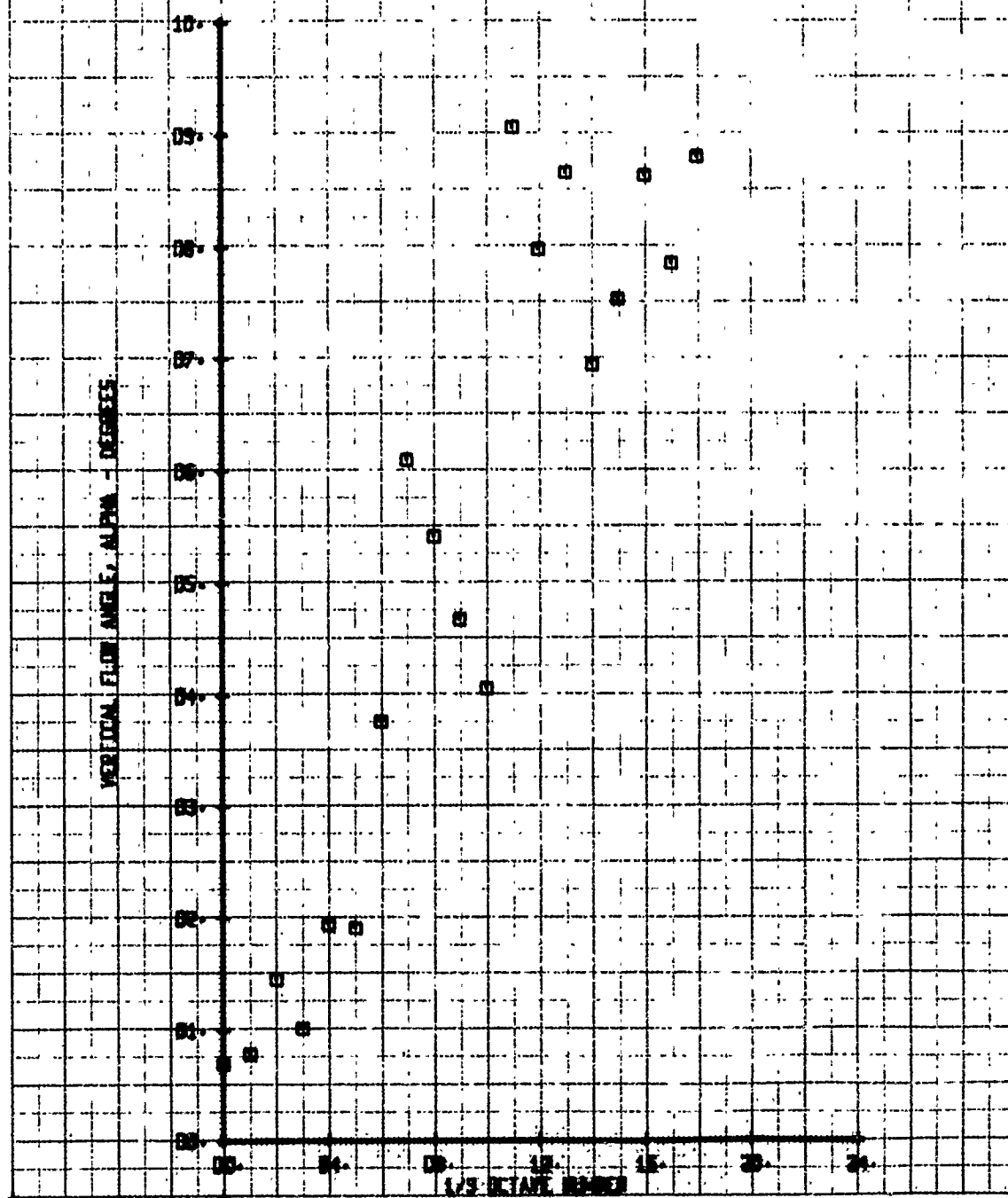


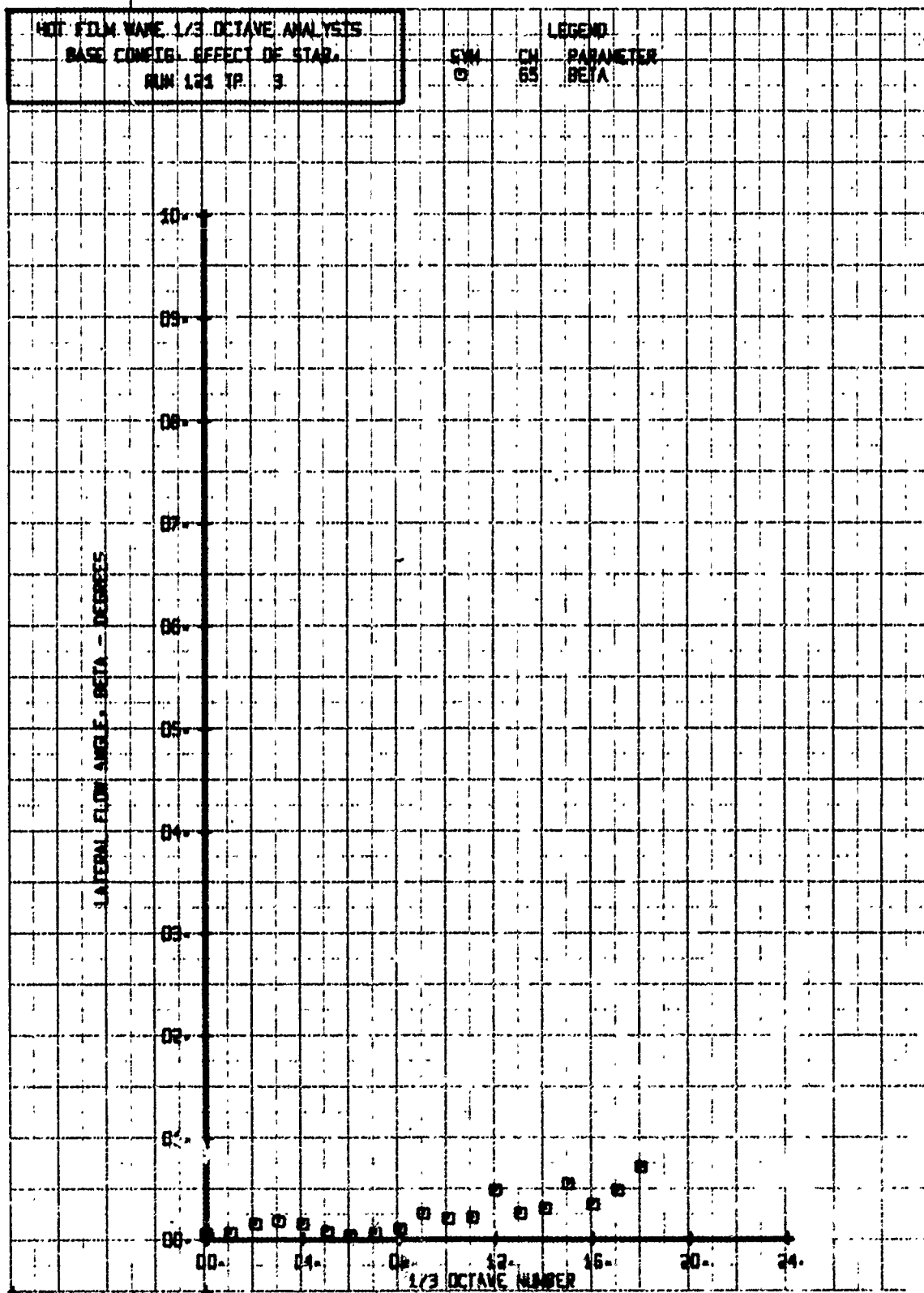
HOT FILM WAKE 1/3 OCTAVE ANALYSIS  
 BASE CONFIG. EFFECT OF STAB.  
 RUN 121 TP 10

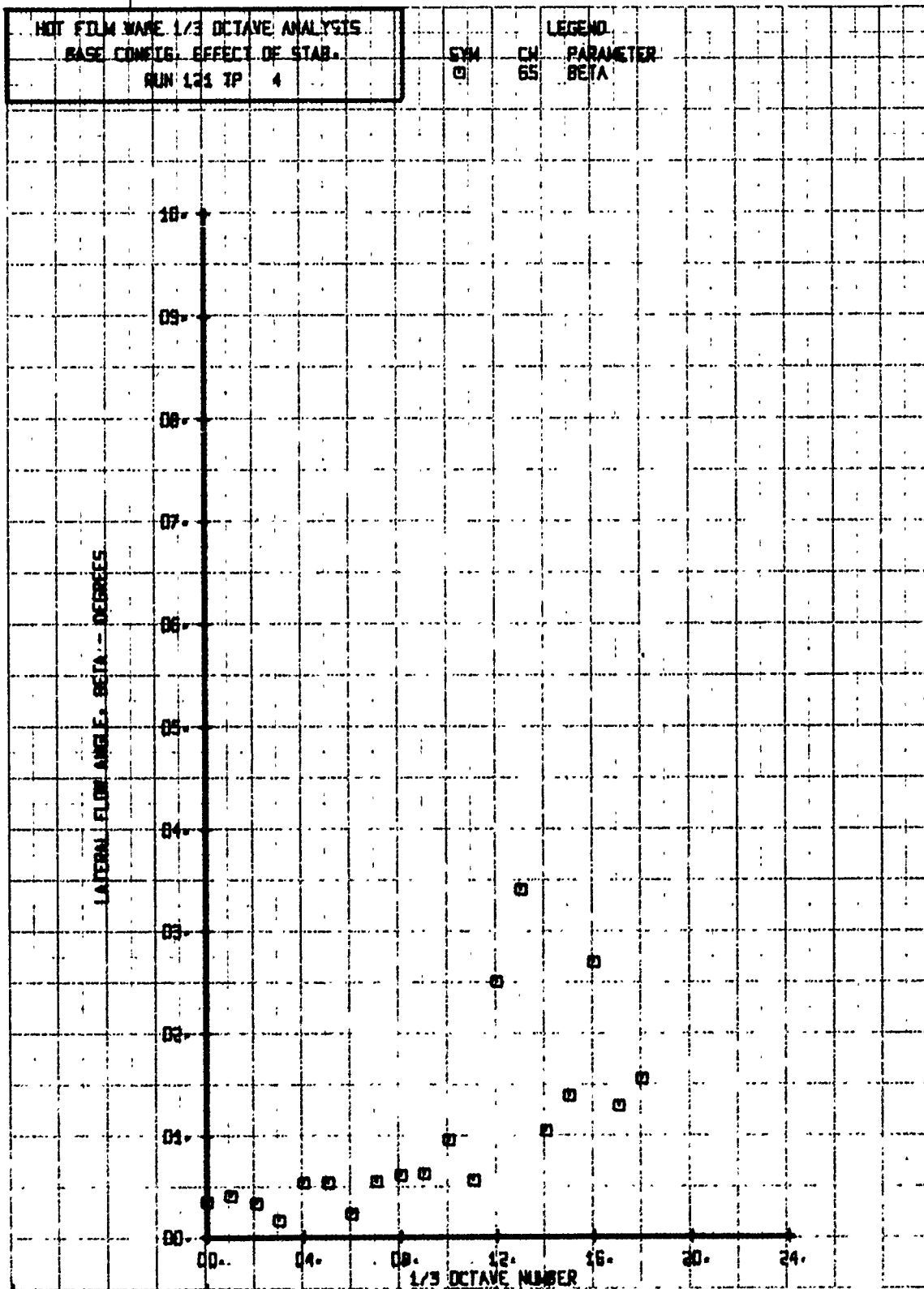
SYM  
 □

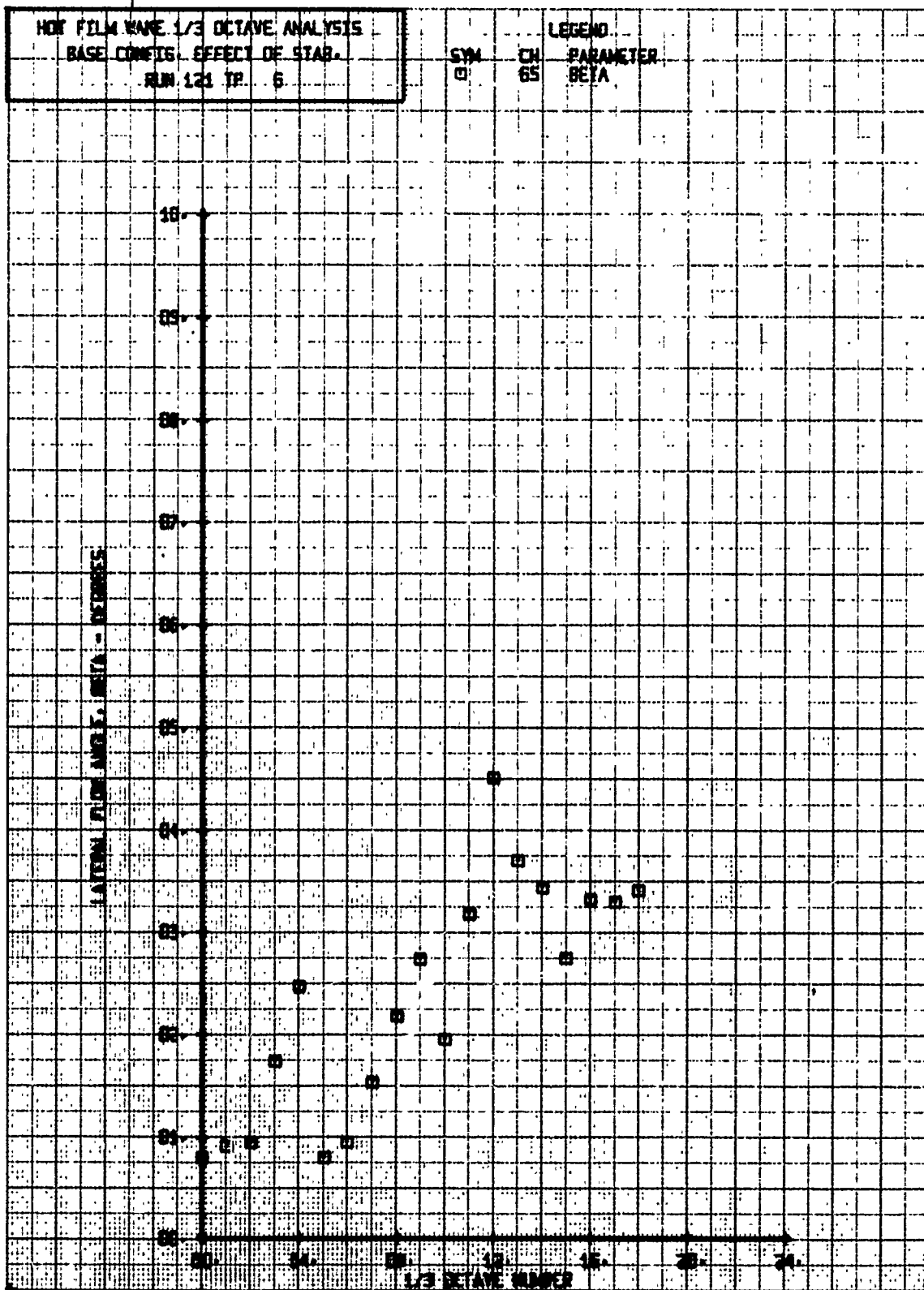
CH  
 66

LEGEND  
 PARAMETER  
 ALPHA











# HOT FILM WAKE 1/3 OCTAVE ANALYSIS

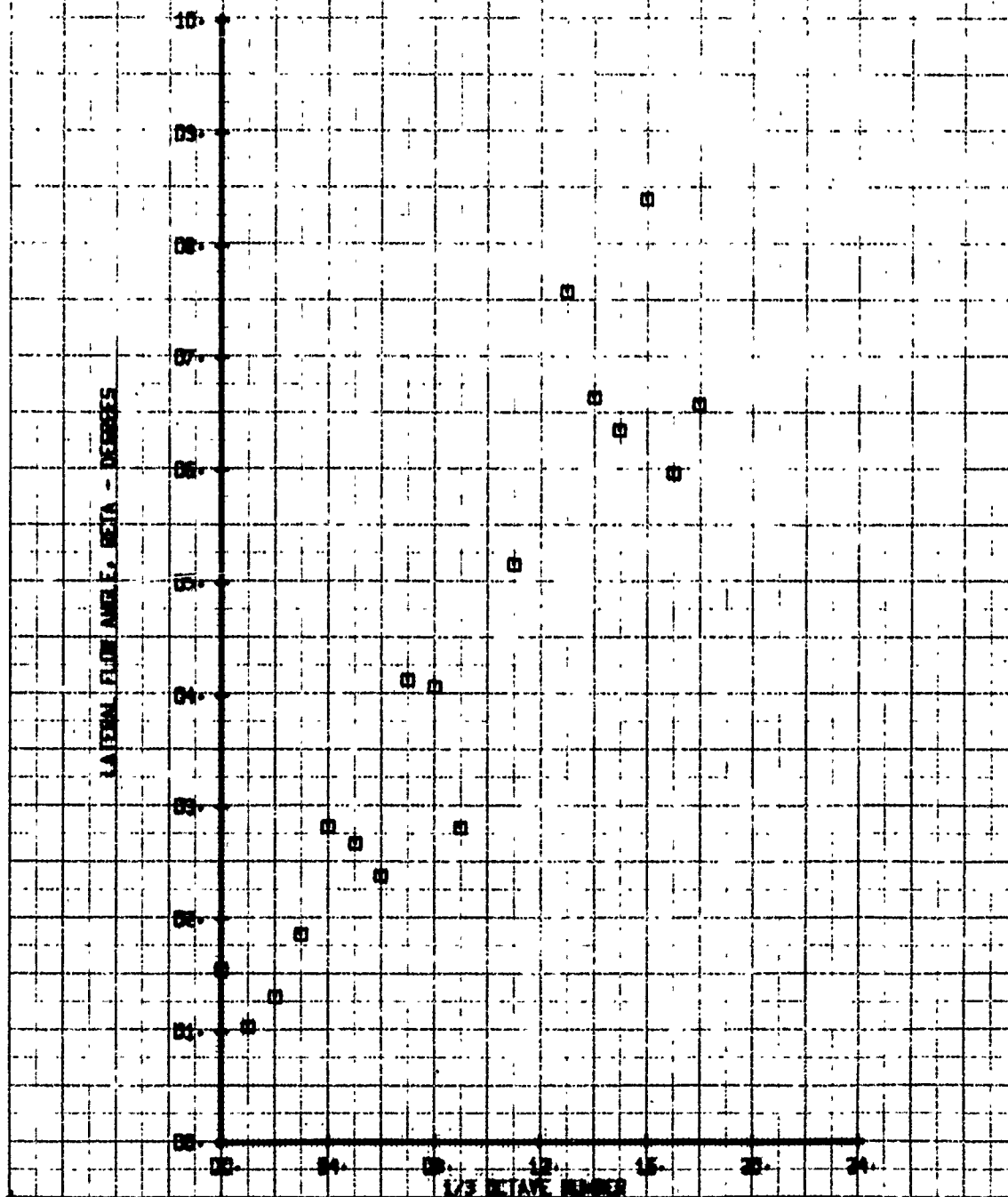
BASE CONFIG. EFFECT OF STAB.

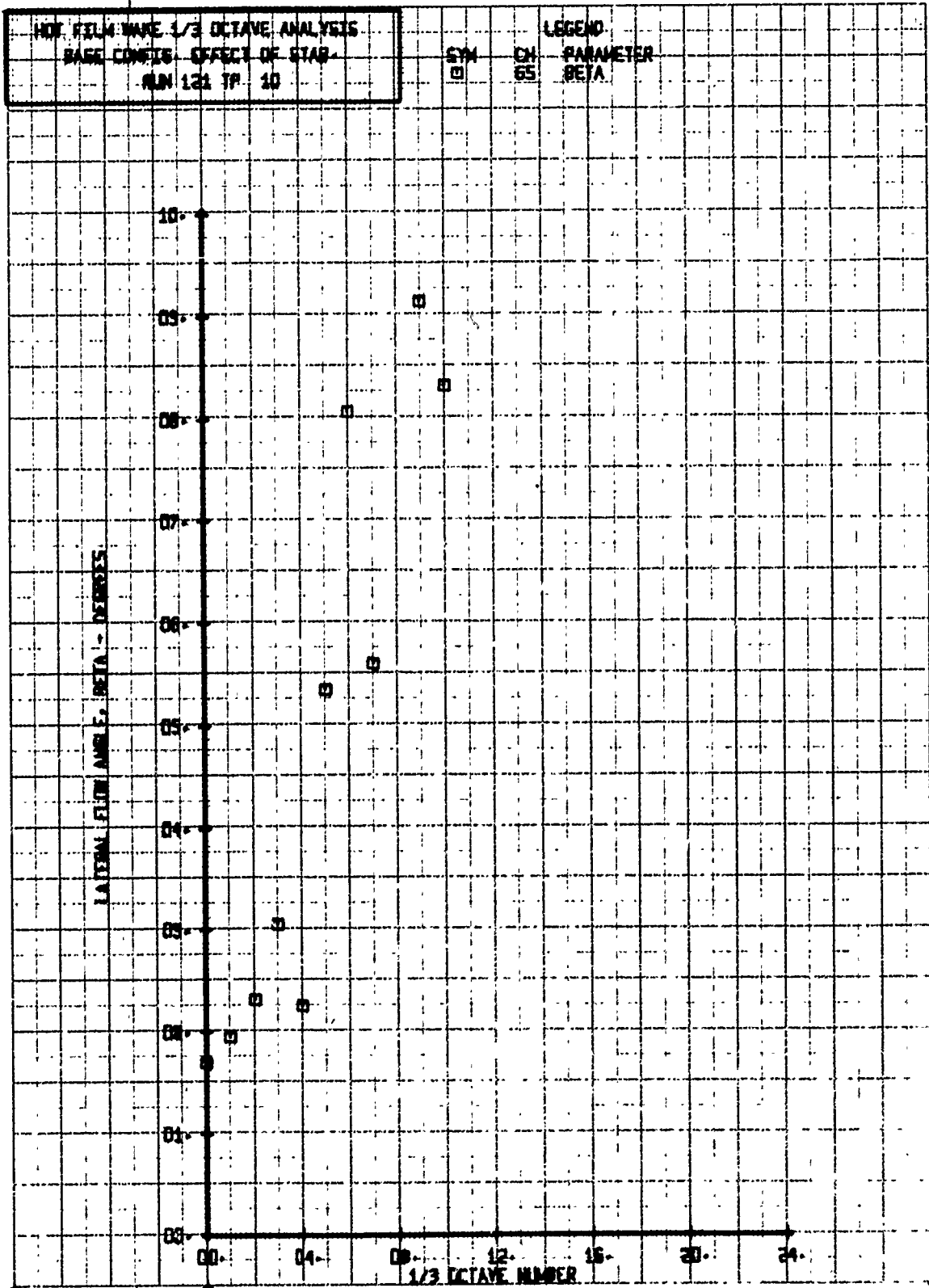
RUN 121 TP 8

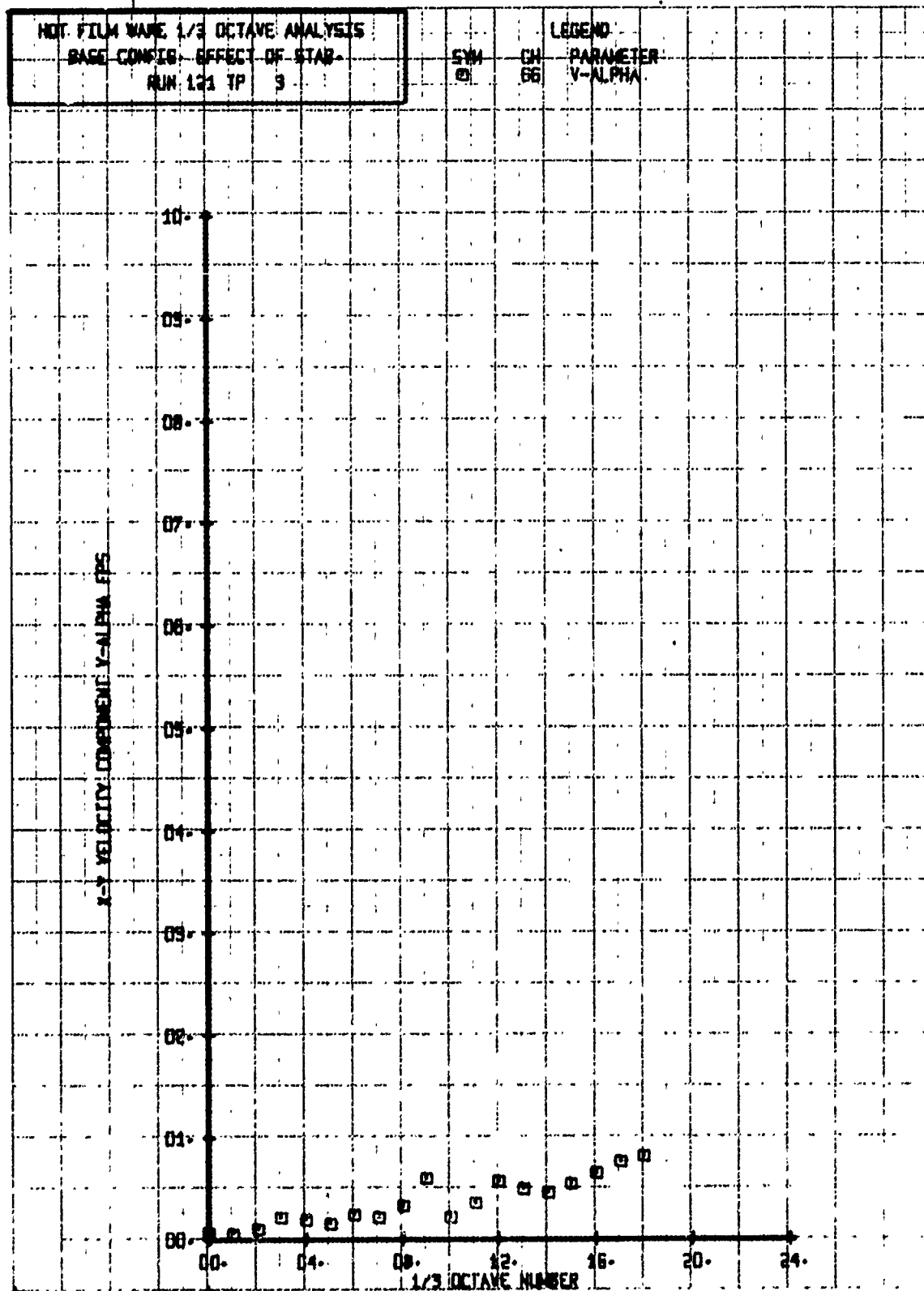
## LEGEND

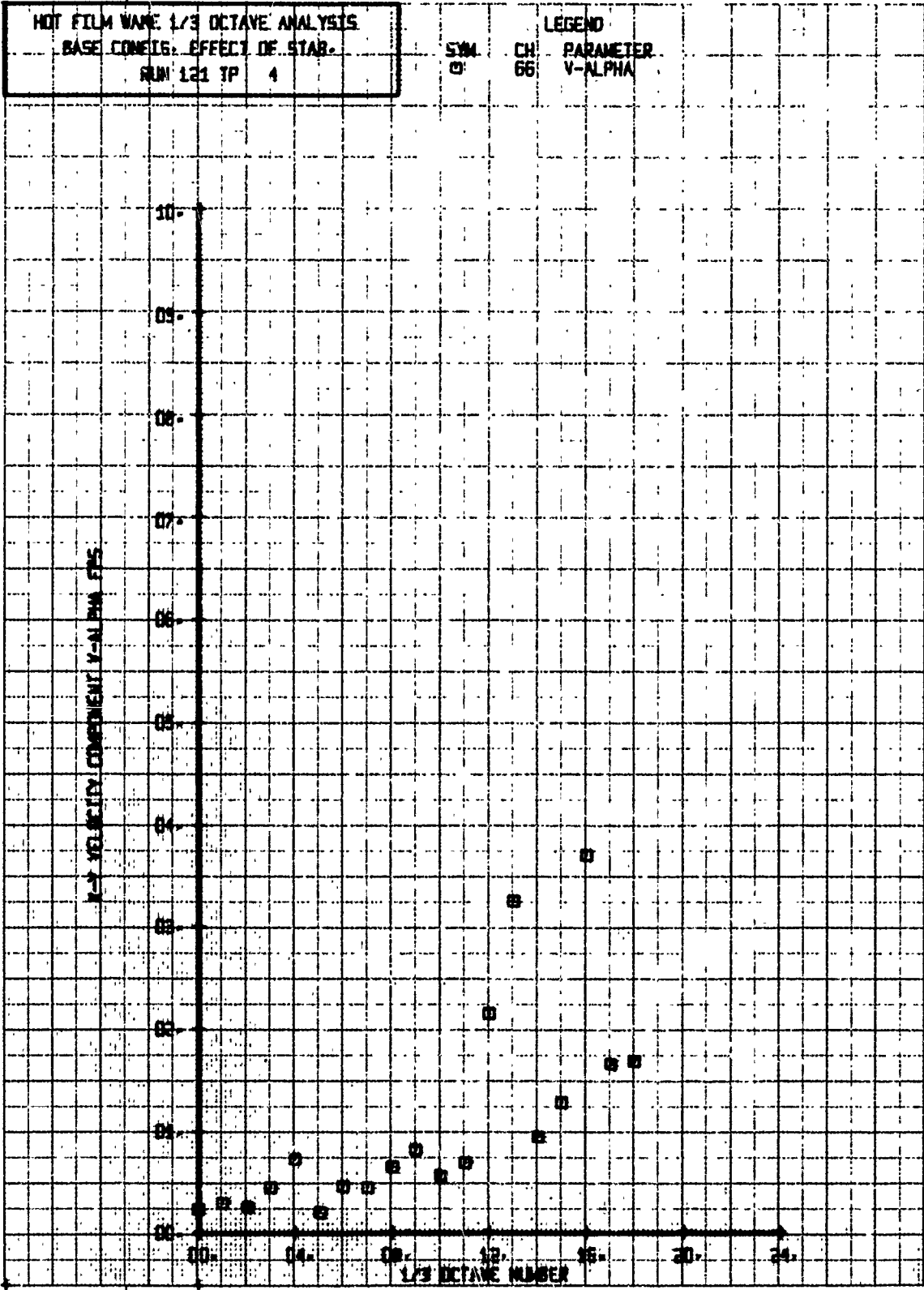
SYM CH PARAMETER  
 □ 65 BETA

LATERAL FLUTE ANGLE, BETA - DEGREES



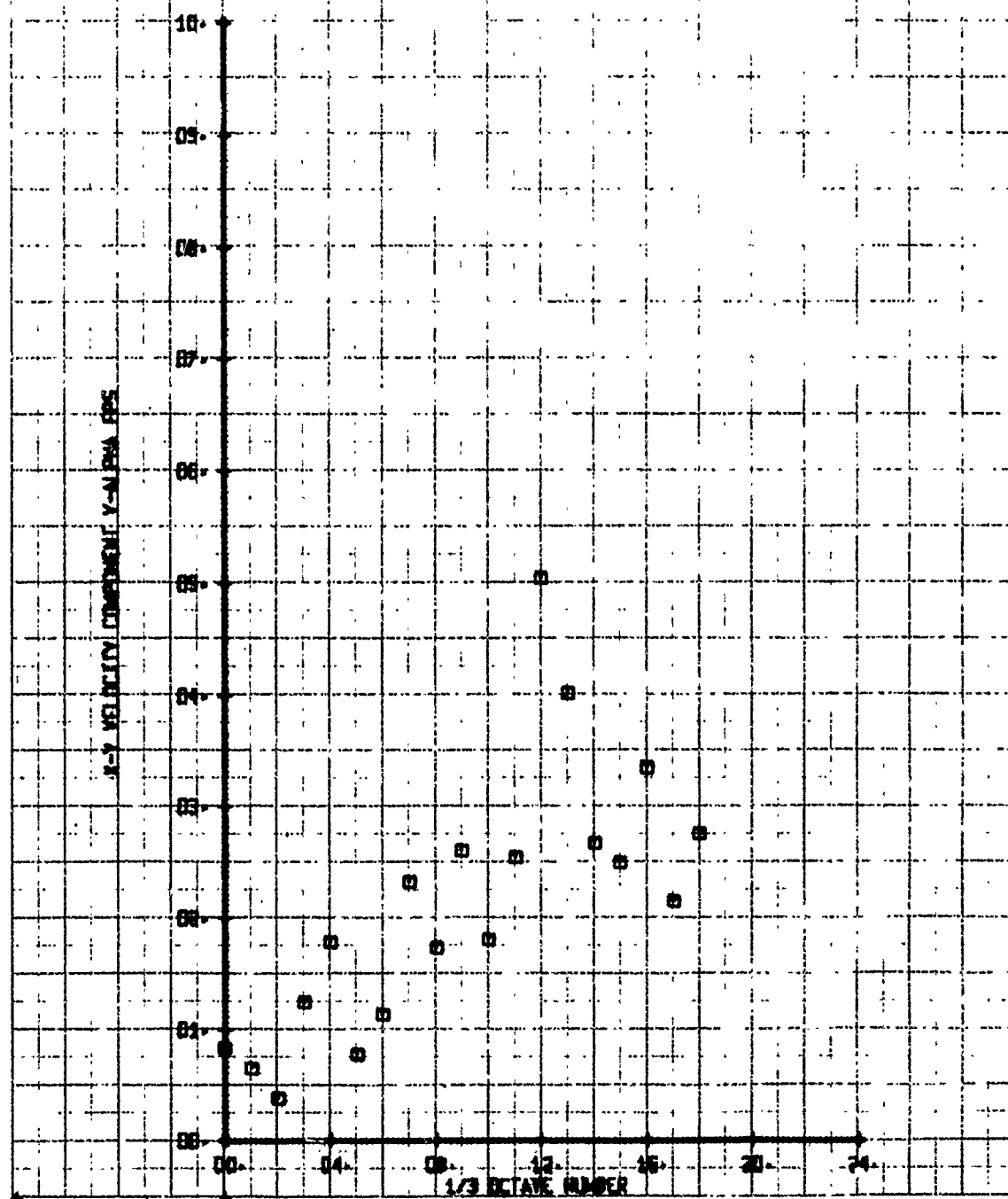


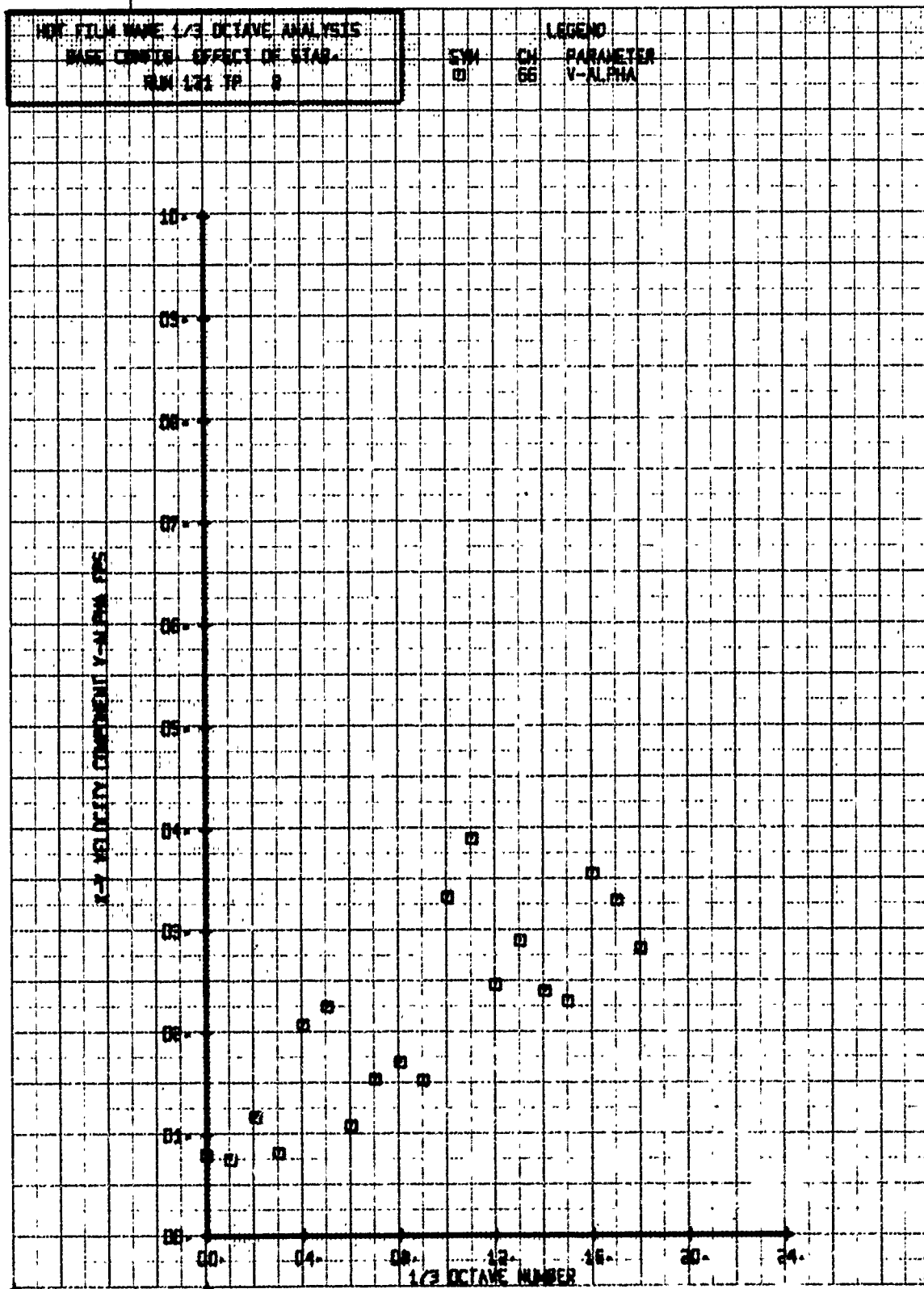




HOT FILM WAVE 1/3 OCTAVE ANALYSIS  
 BASE CONFIG. EFFECT OF STAB.  
 RUN 121 TP 6

LEGEND  
 CH: PARAMETER  
 66: V-ALPHA

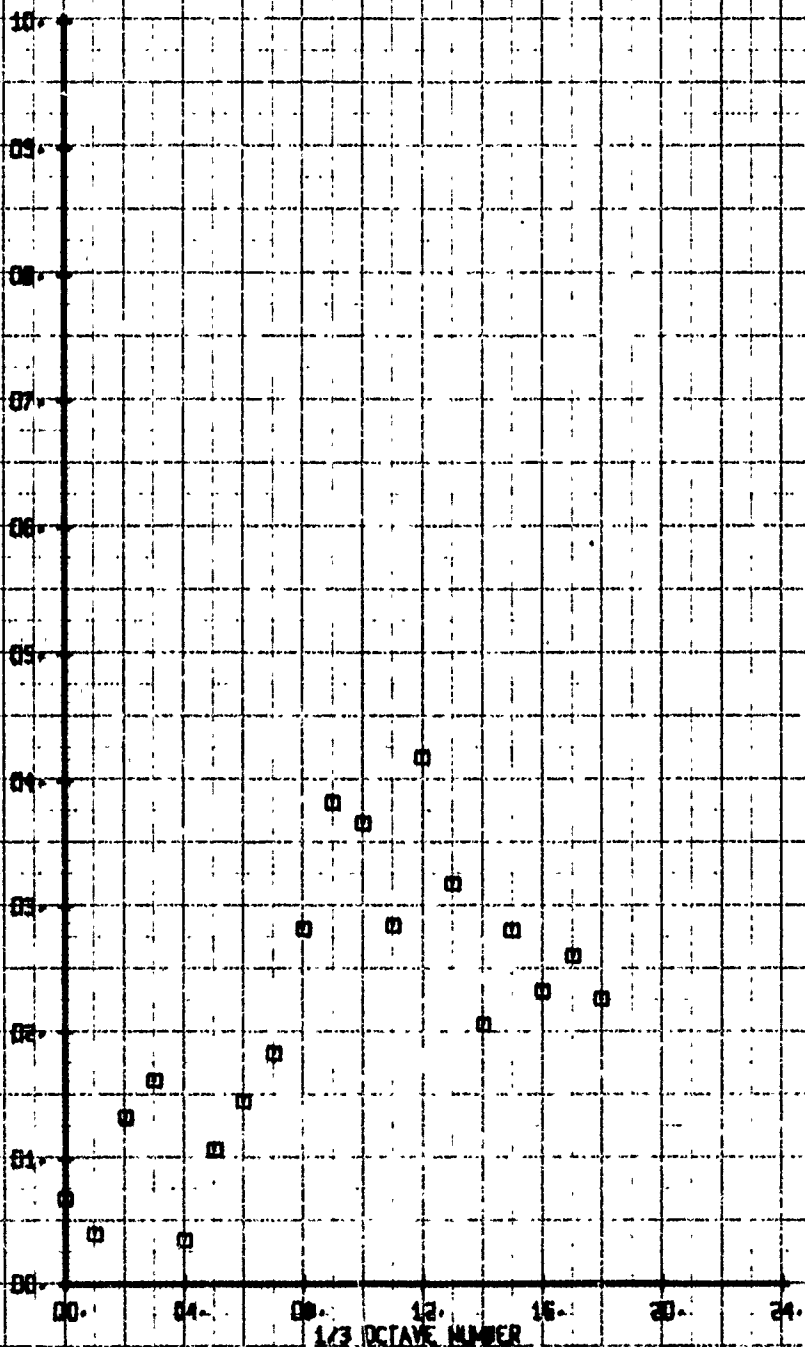


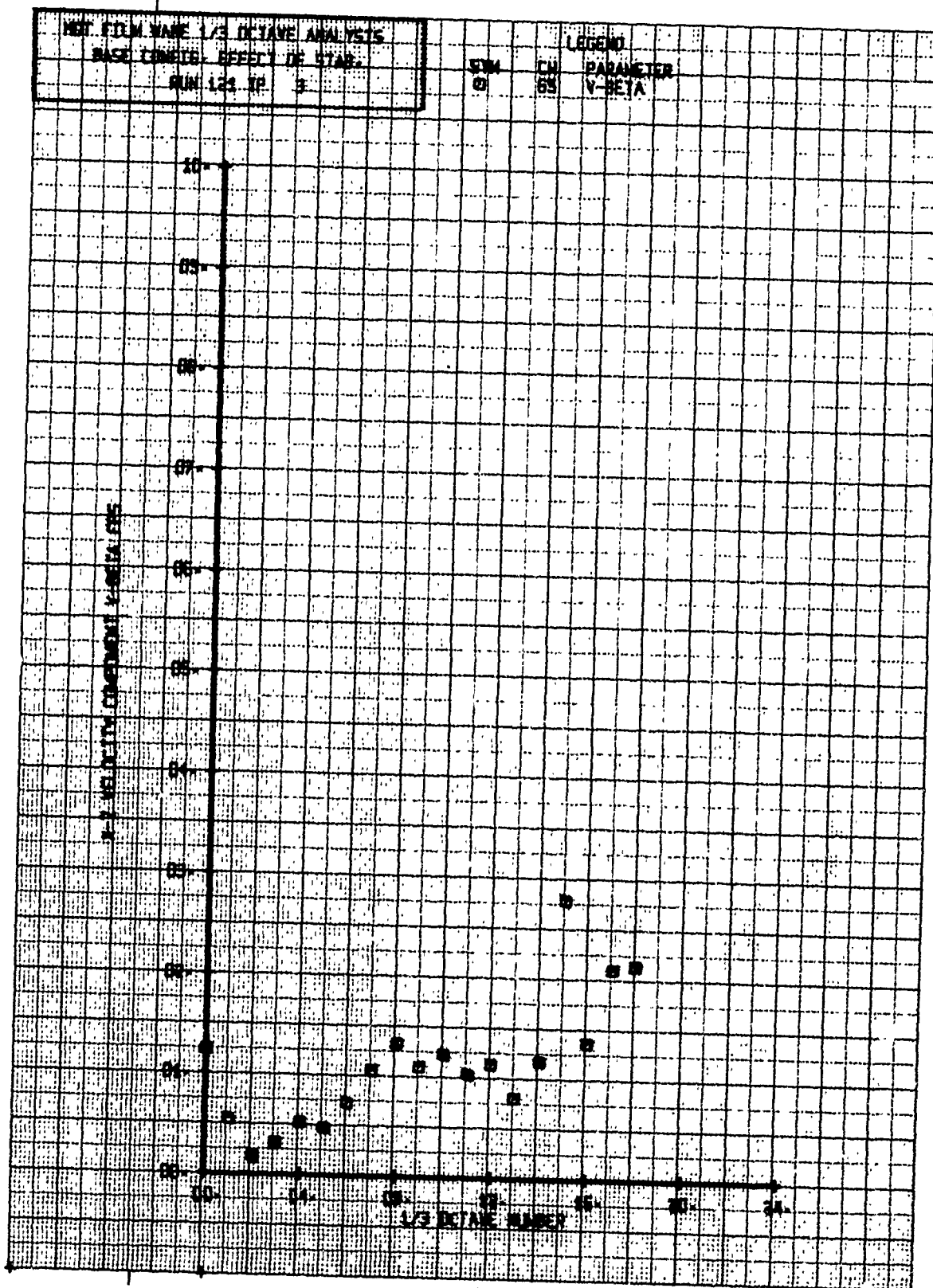


HOT FILM WAKE 1/3 OCTAVE ANALYSIS  
 BASE CONFIG EFFECT OF STAB.  
 RUN 121 TP 10

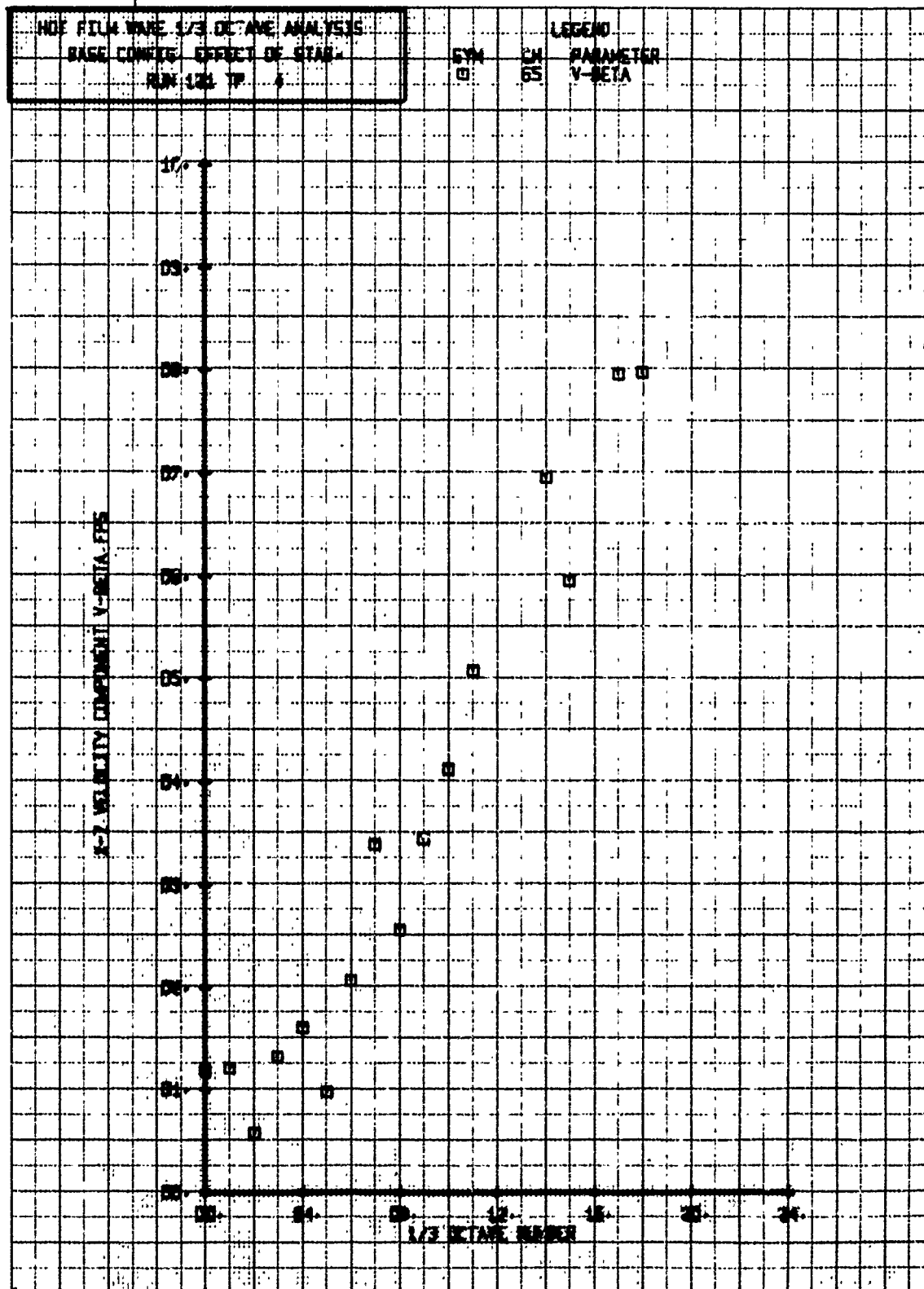
SYM CH  
 □ 66  
 LEGEND  
 PARAMETER  
 V-ALPHA

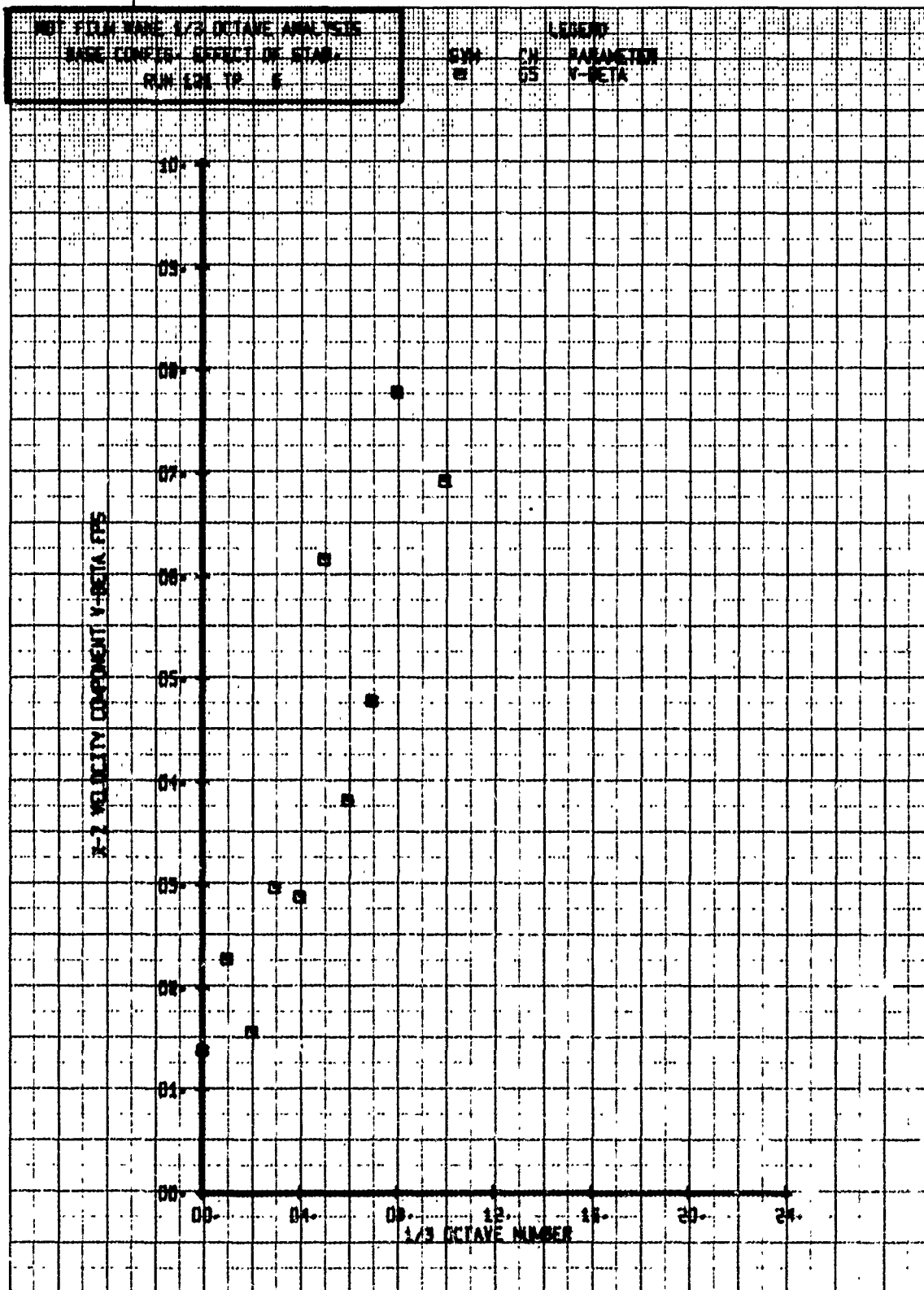
X-Y VELOCITY COMPONENT V-ALPHA FPS

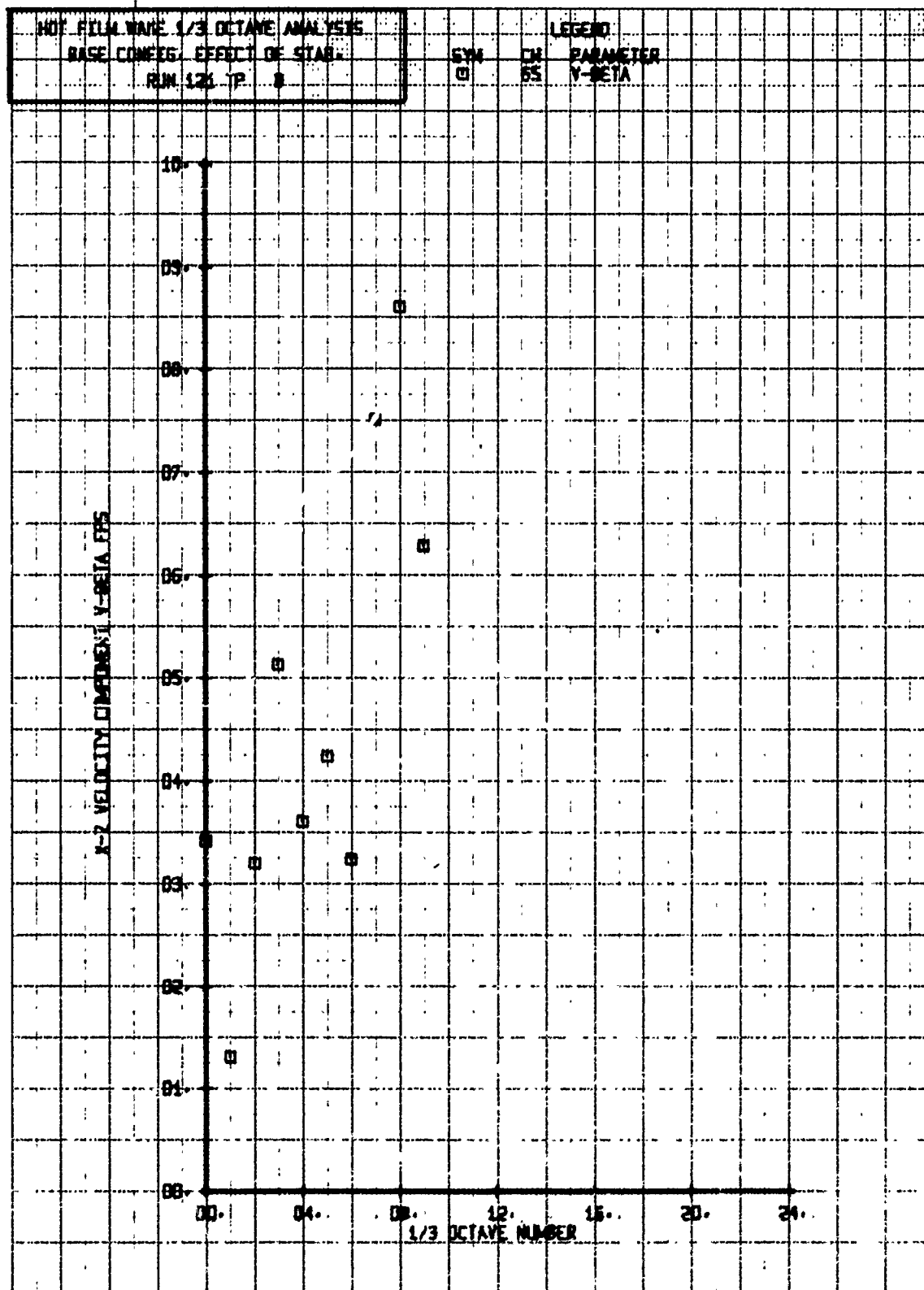


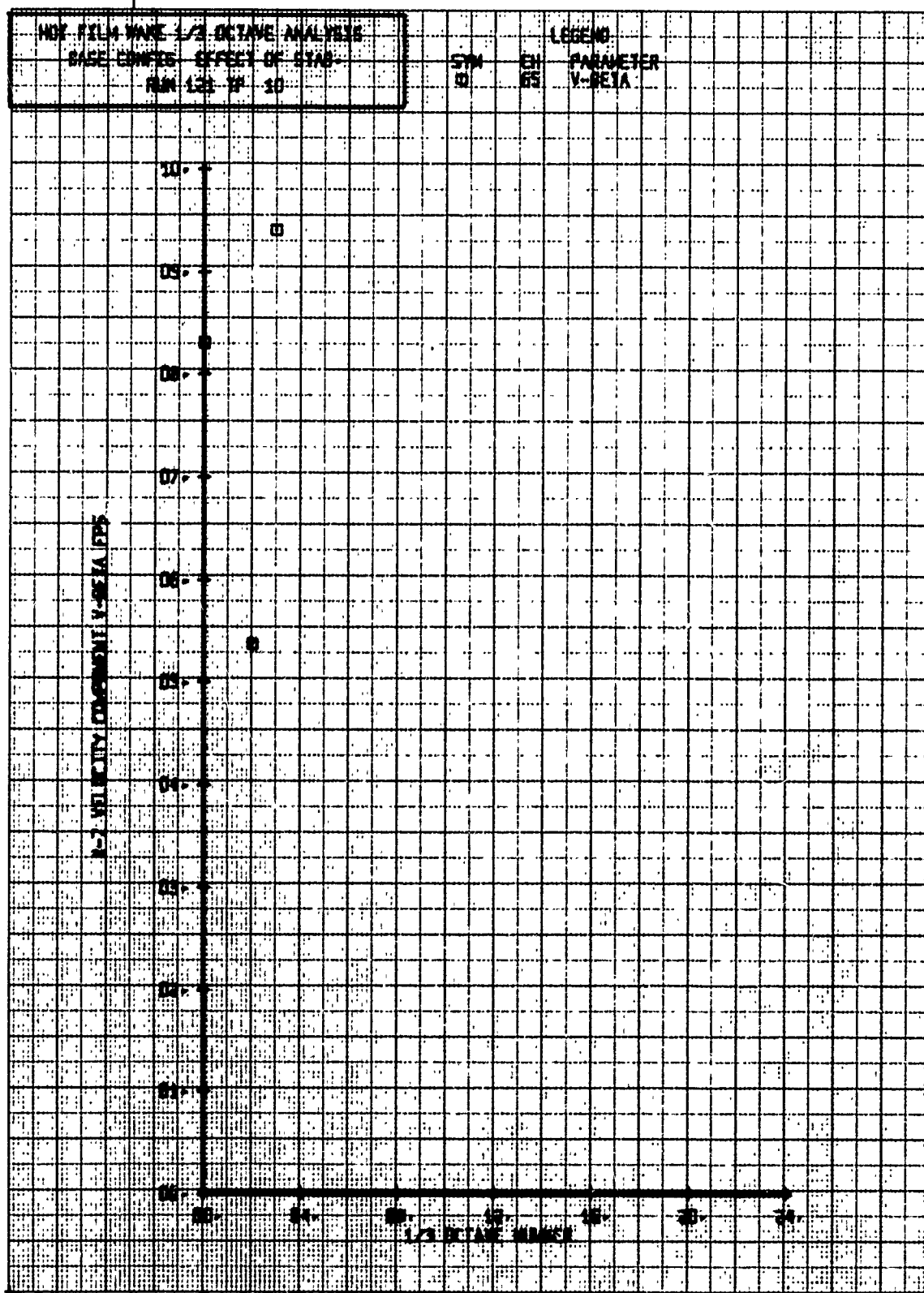






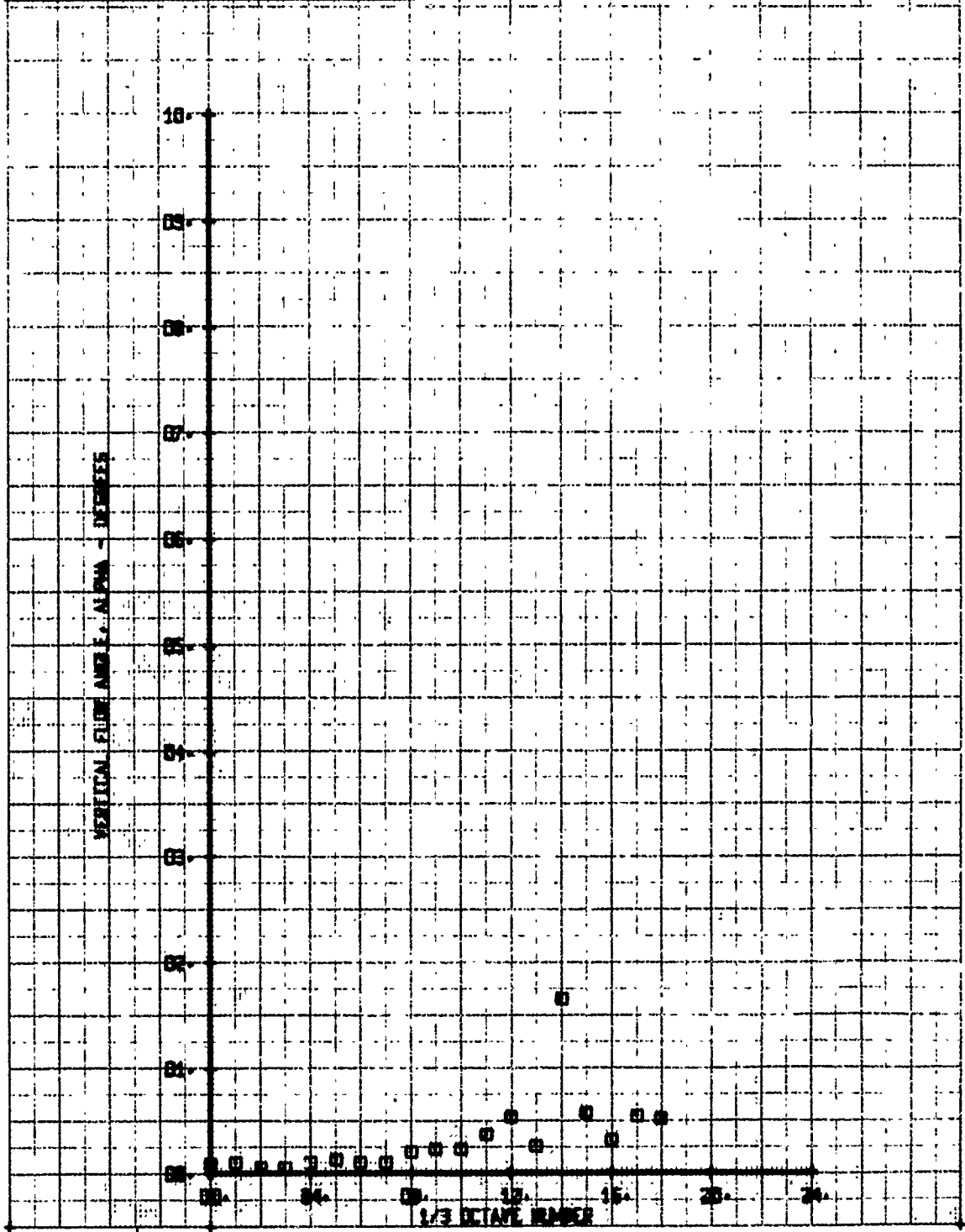


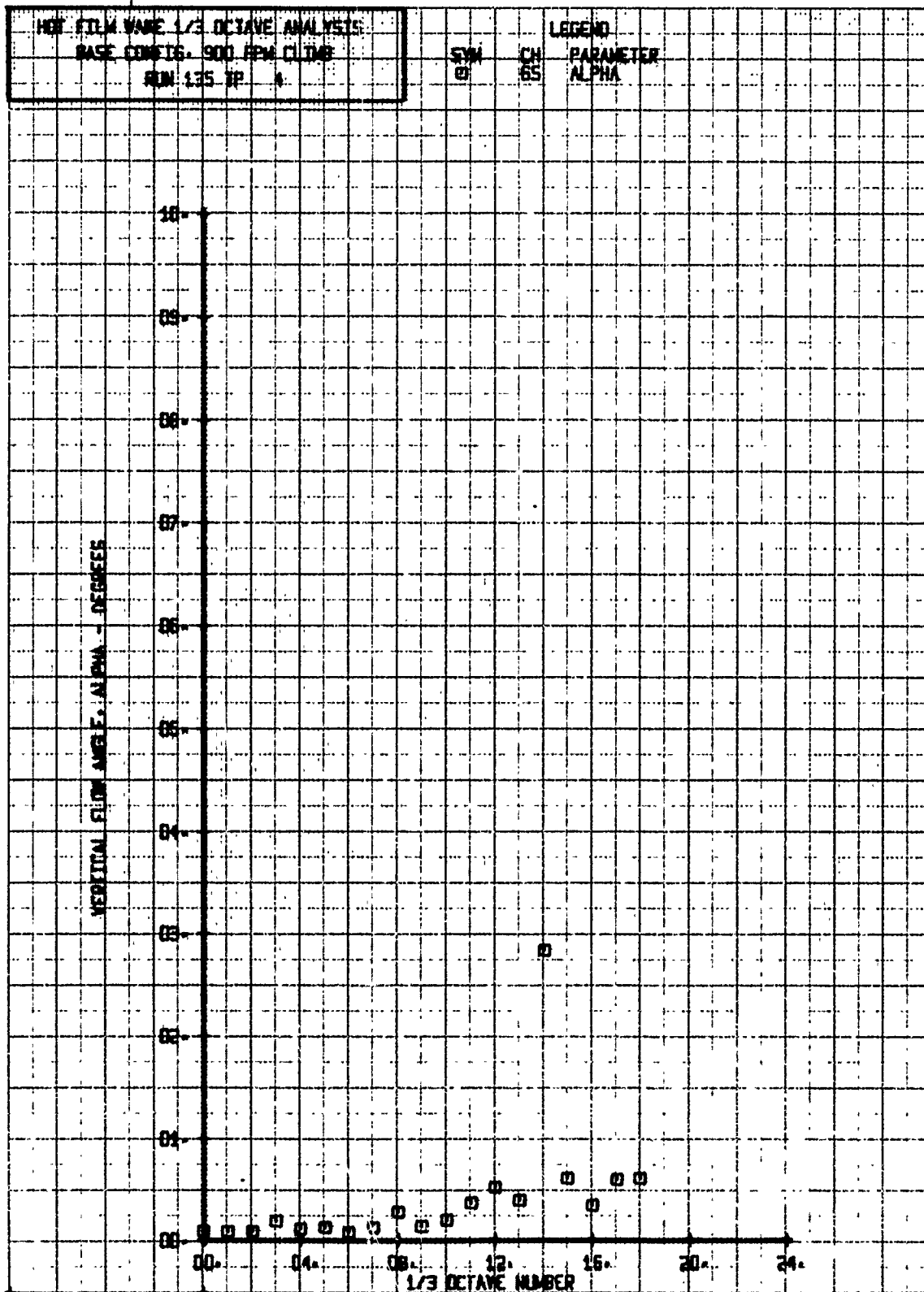


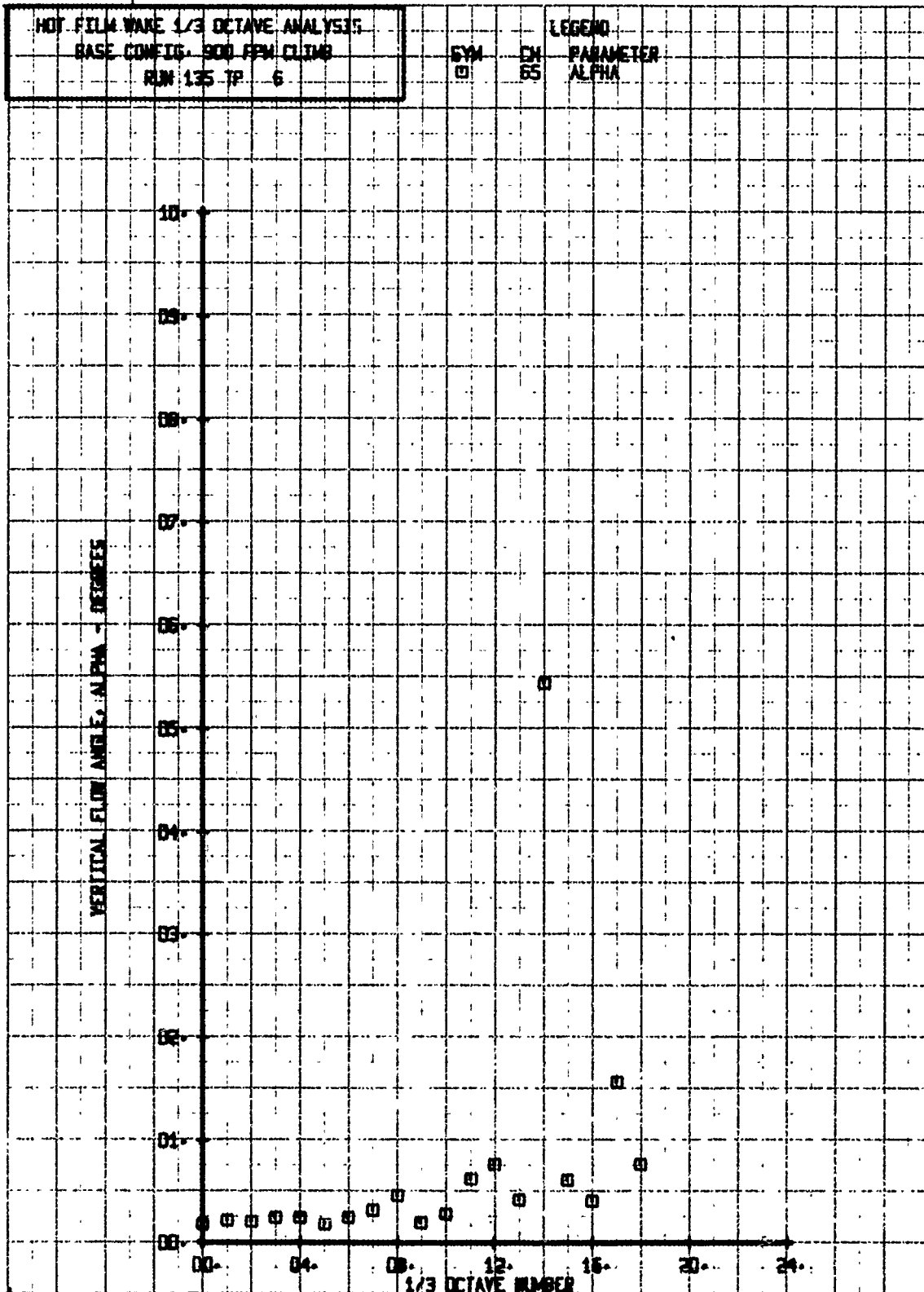


HOF FILM WARE 1/3 OCTAVE ANALYSIS  
 BASE CONFIG. 900 FPM CLIMB  
 RUN 135 TP 2

SYM CH PARAMETER  
 0 65 ALPHA

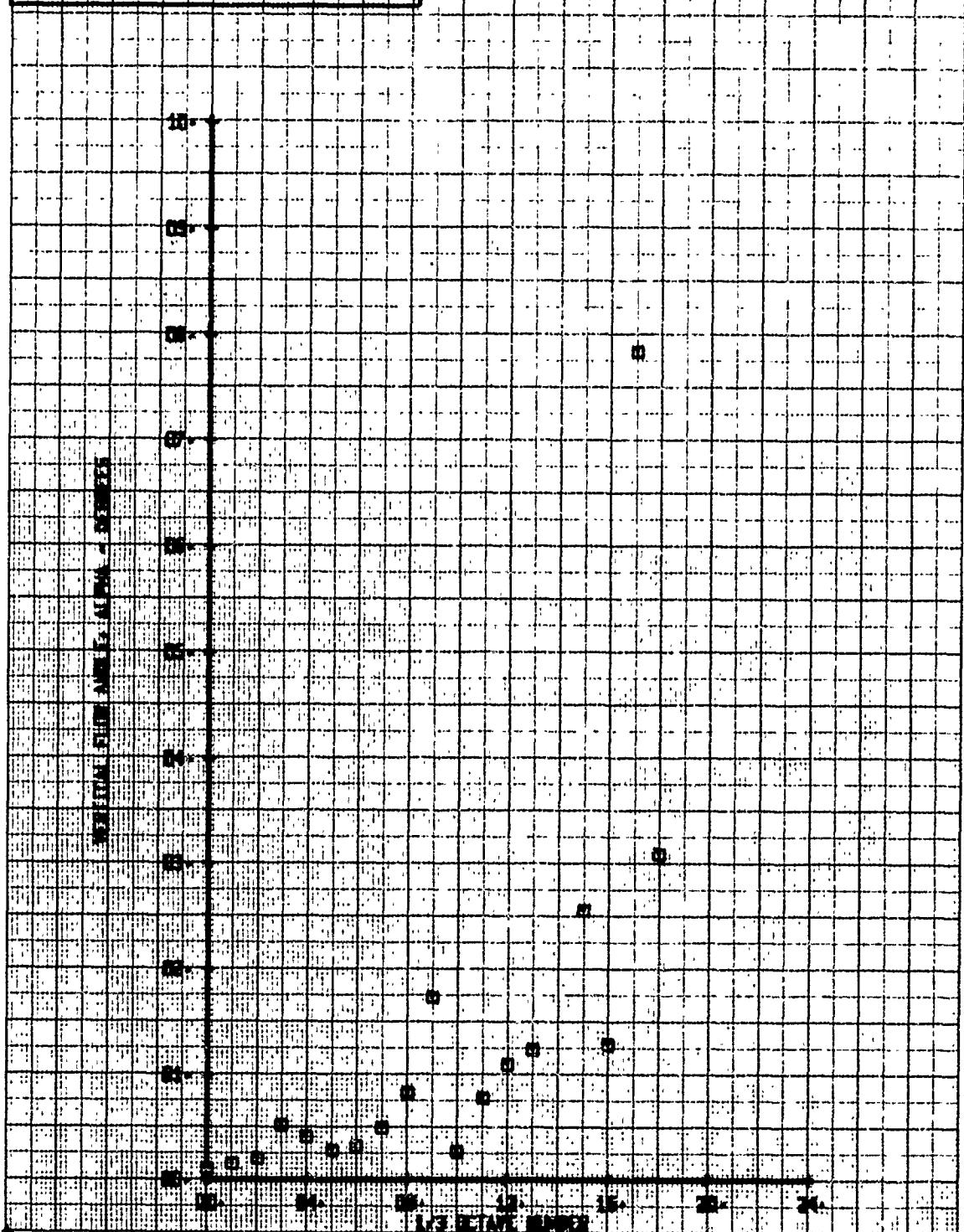






NOI FILM WAVE 1/3 OCTAVE ANALYSIS  
 BASE CONFIG. 900 FPM CLIMB  
 RUN 125 TP 8

SYN CH  
 0 65  
 LEGEND  
 PARAMETER  
 ALPHA





# HOT FILM WAKE 1/3 OCTAVE ANALYSIS

BASE COW/16 900 FPM CLIMB

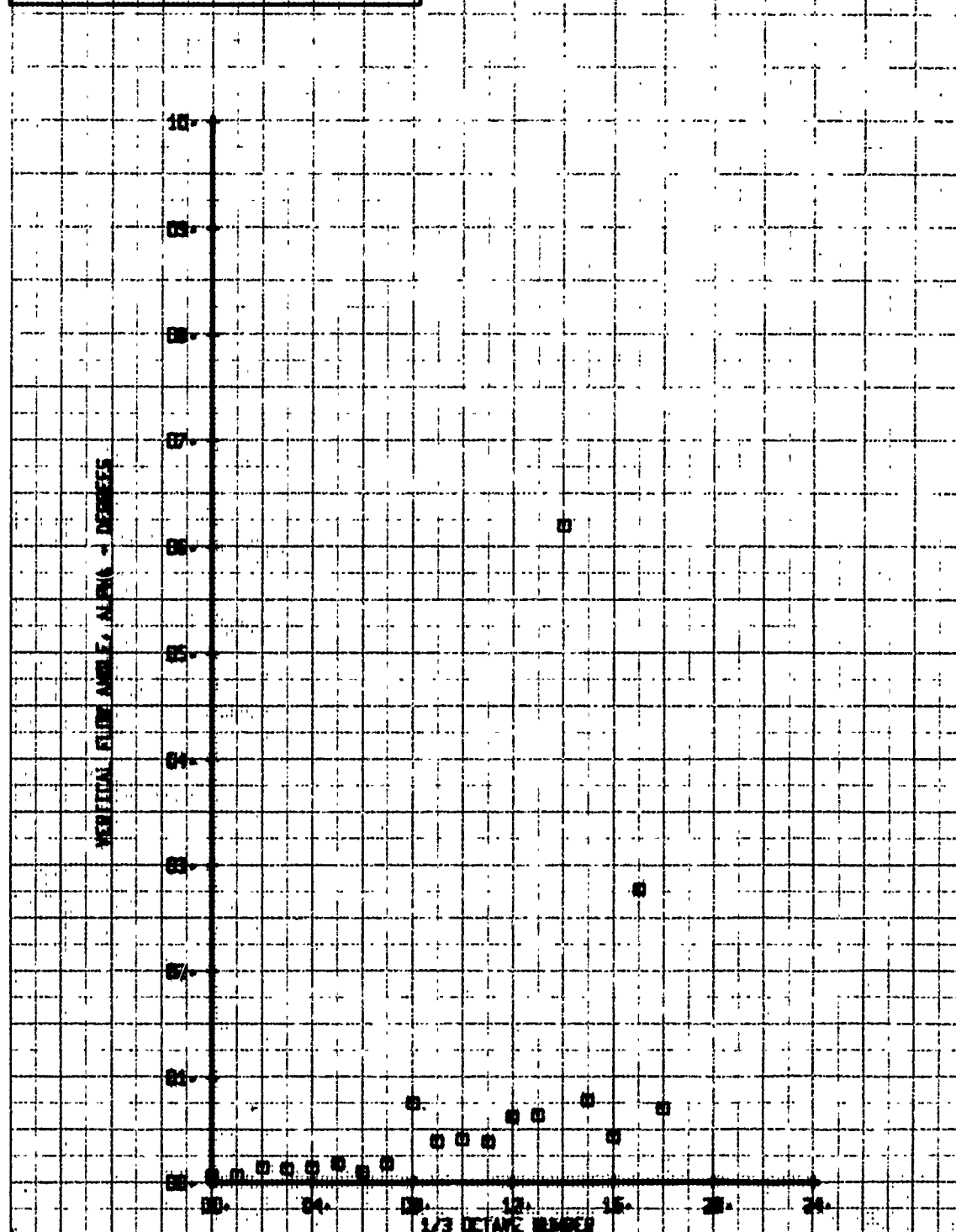
RUN 135 TP 10

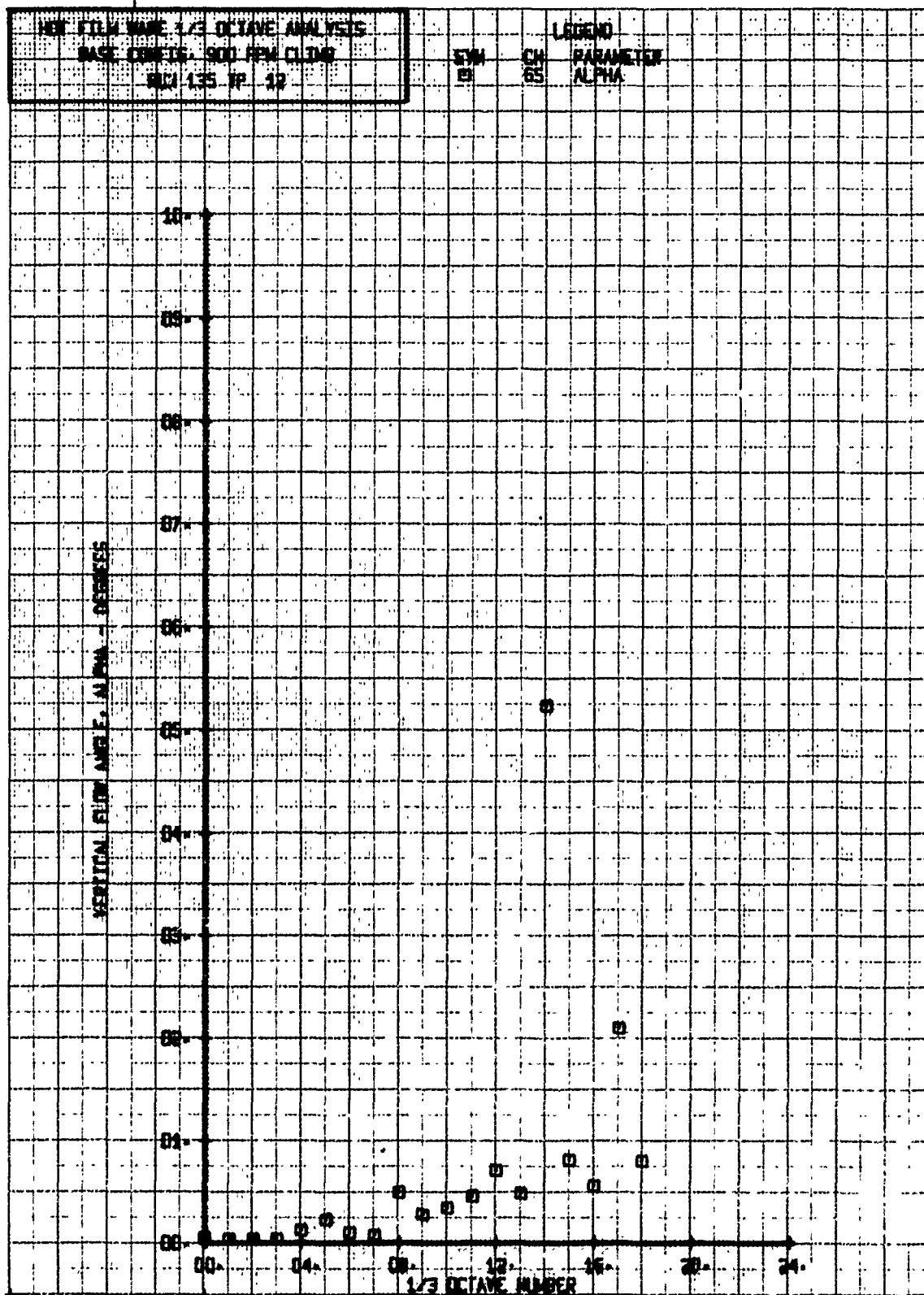
SYM  
□

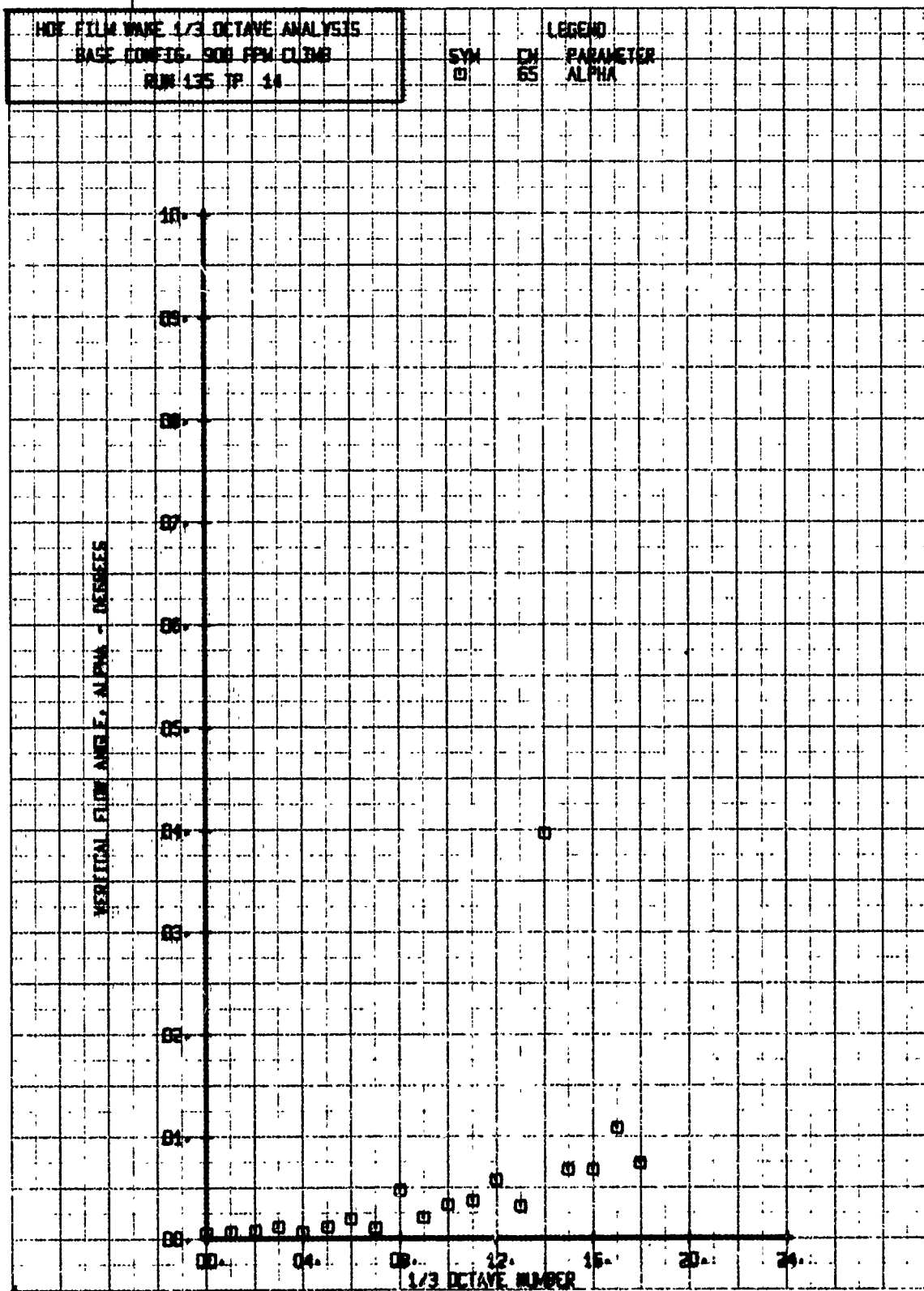
CH  
65

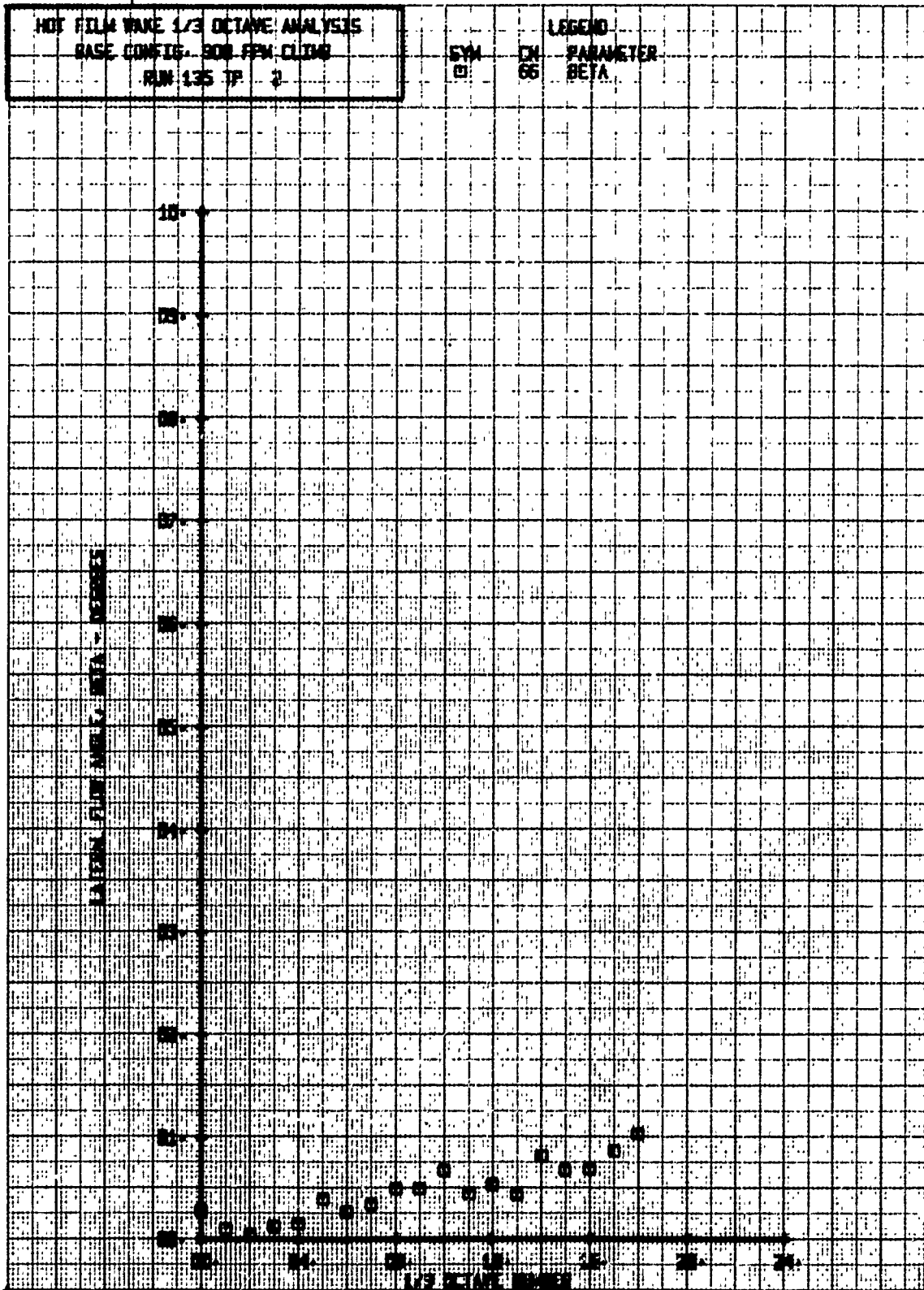
## LEGEND

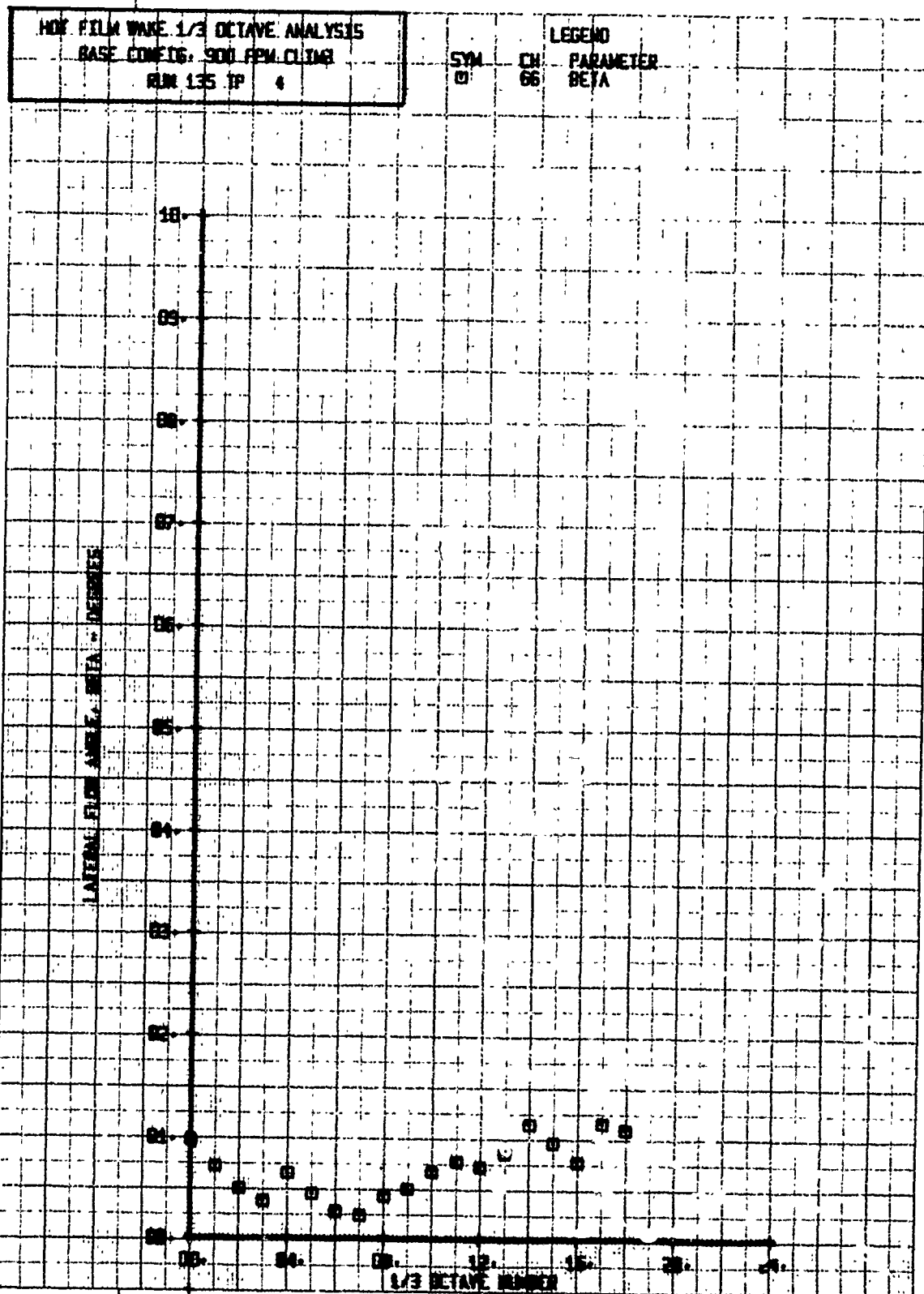
PARAMETER  
ALPHA

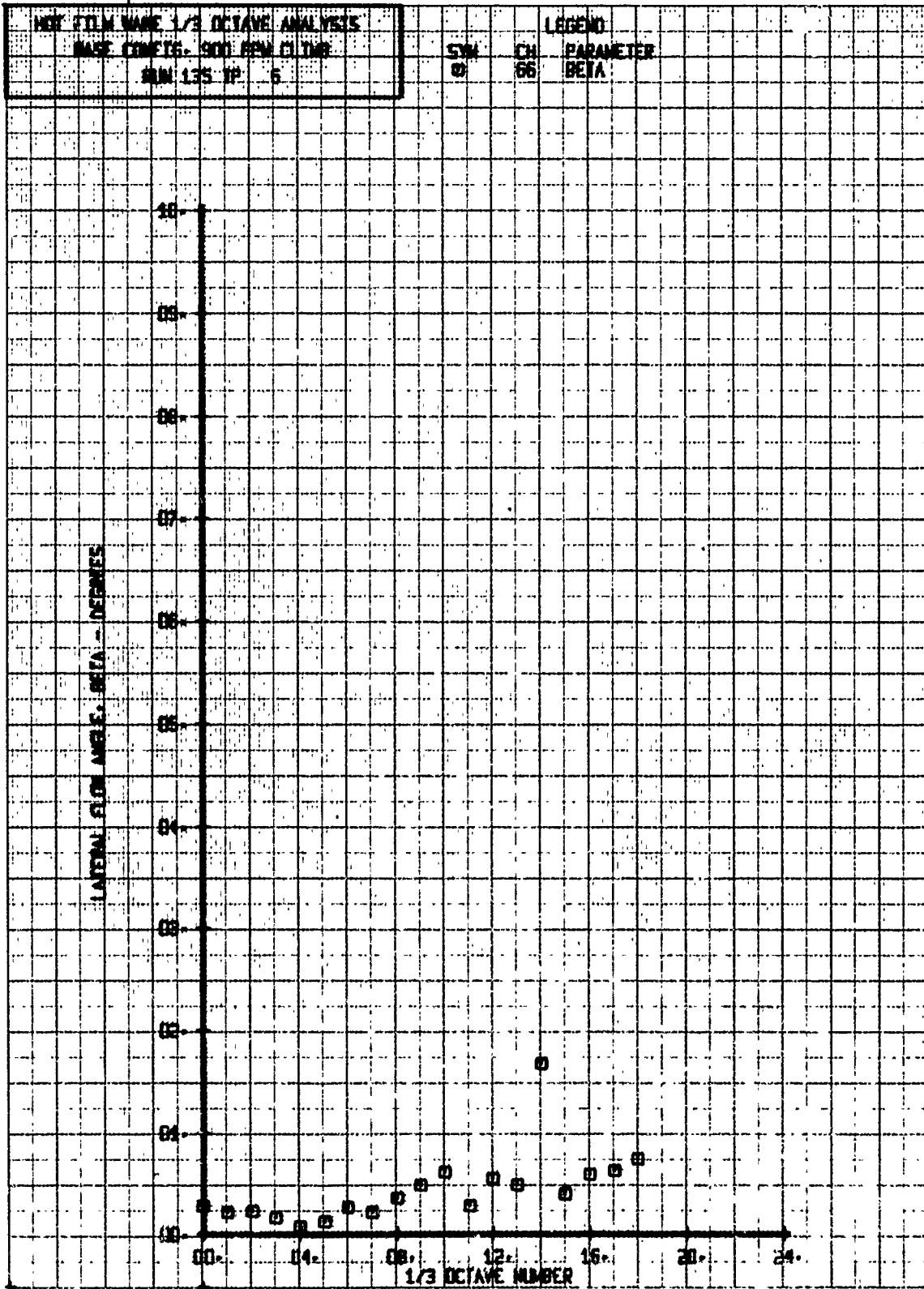


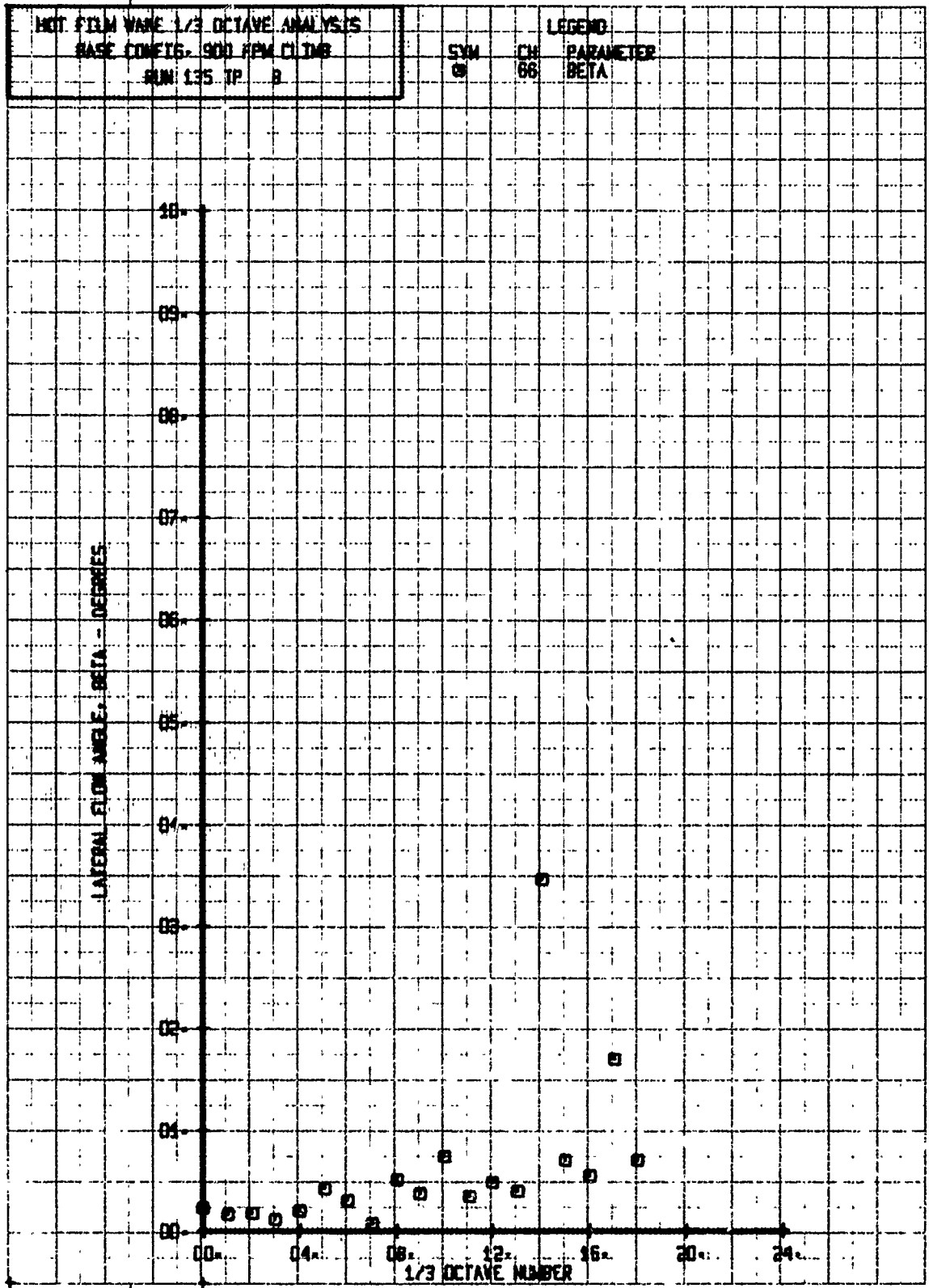




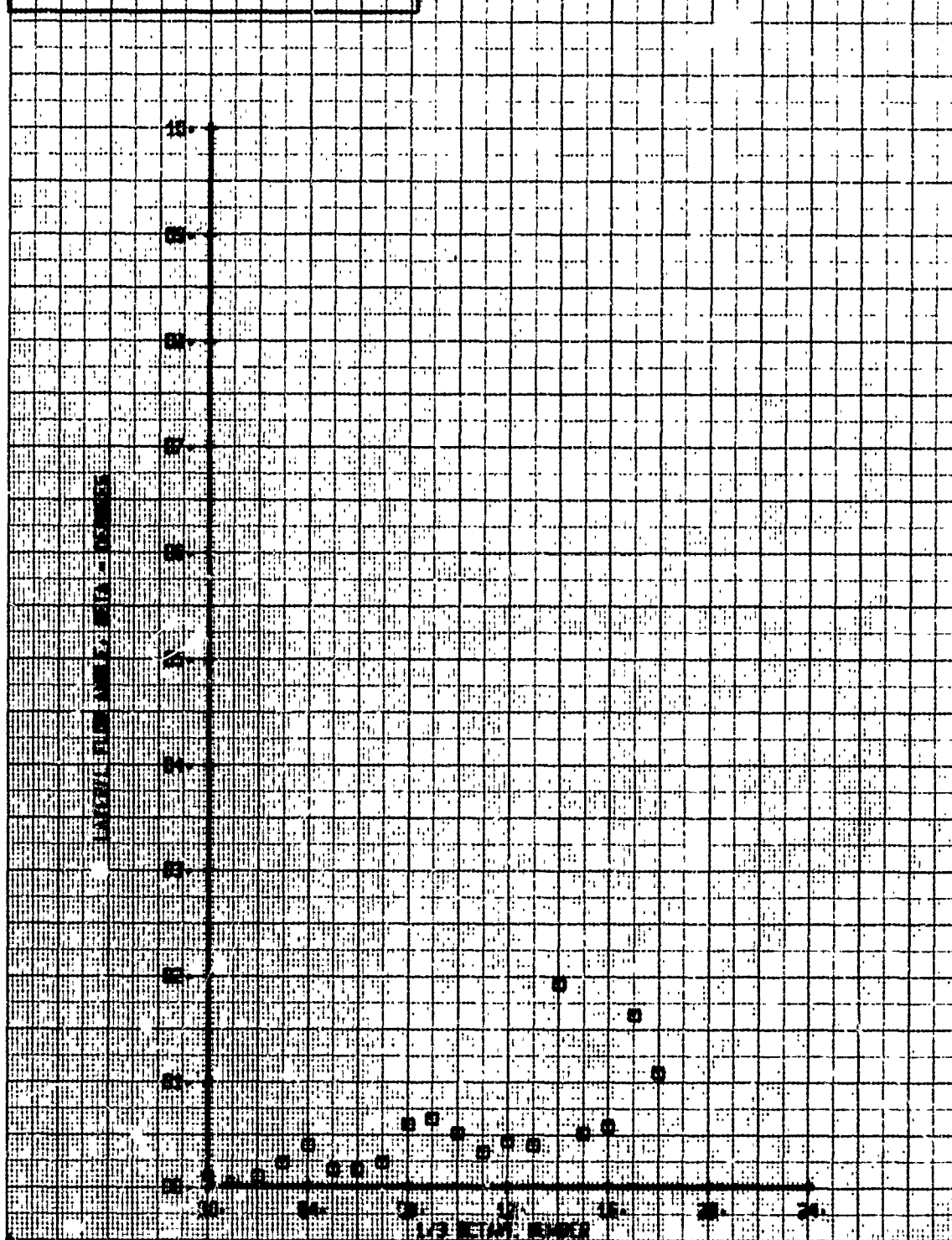








| LEGEND |    |           |
|--------|----|-----------|
| SYM    | CH | PARAMETER |
| (1)    | 66 | BETA      |





# HOT FILM WAVE 1/3 OCTAVE ANALYSIS

BASE CONE 16, 900 RPM CLIMB

RUN 135 TP 12

SYM

01

CH

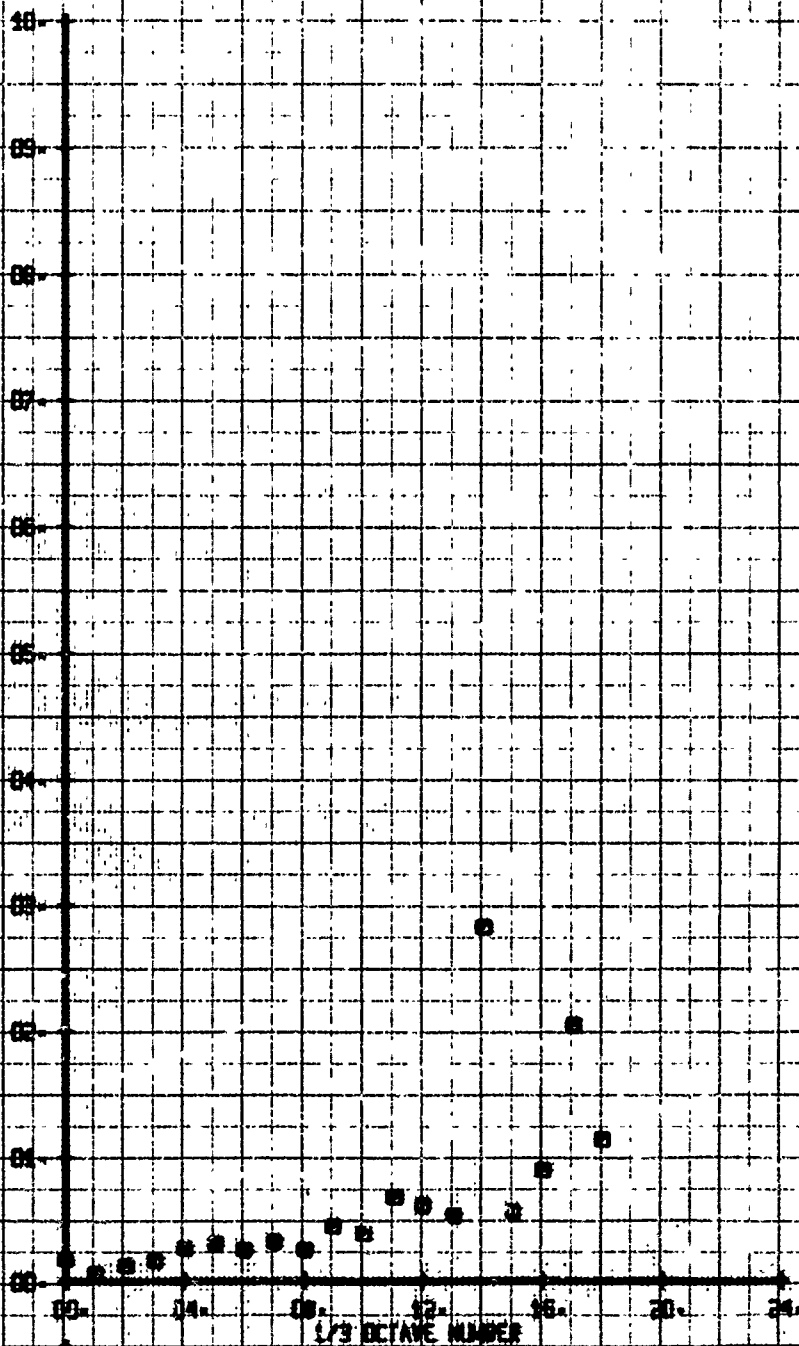
66

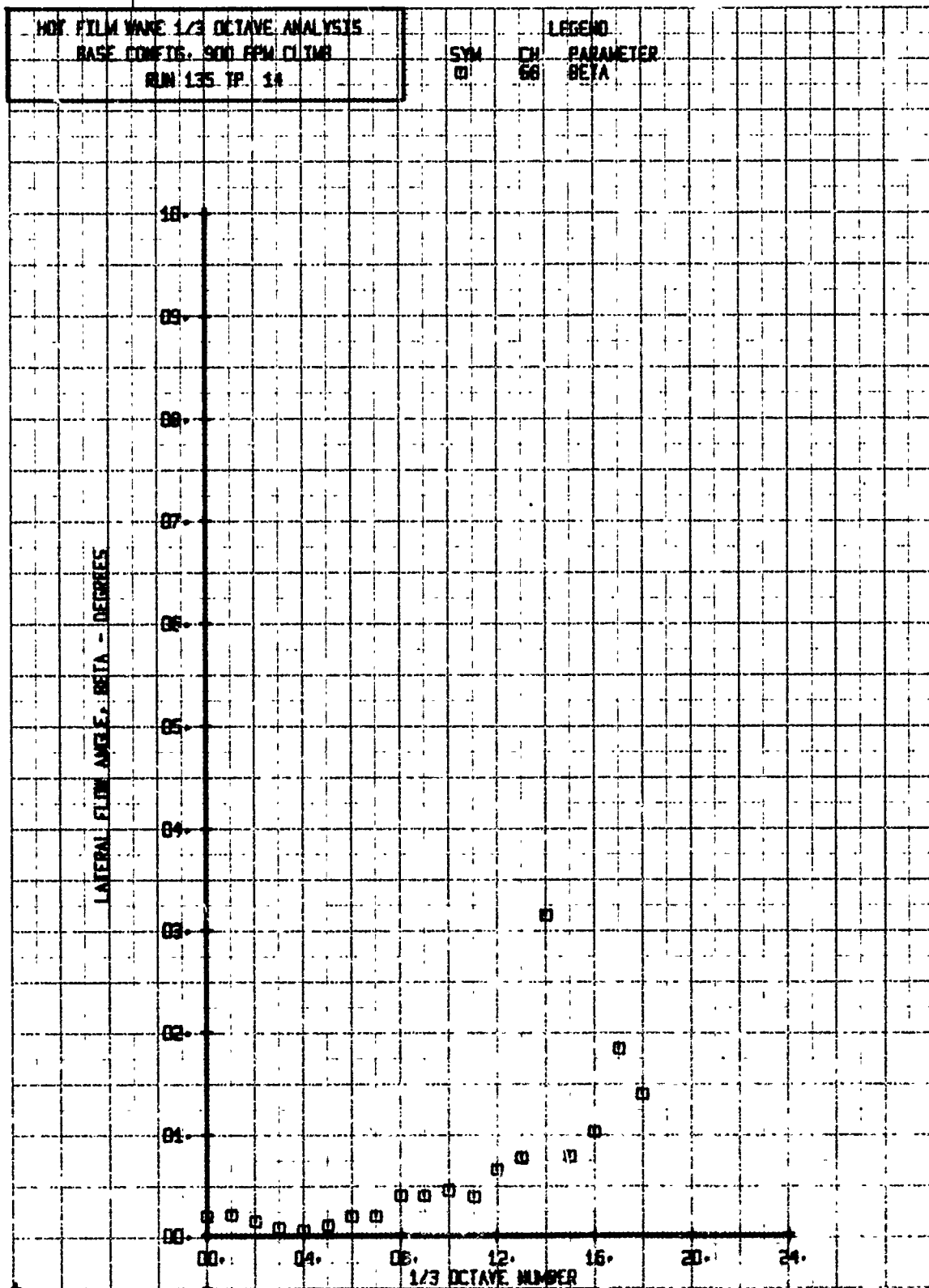
LEGEND

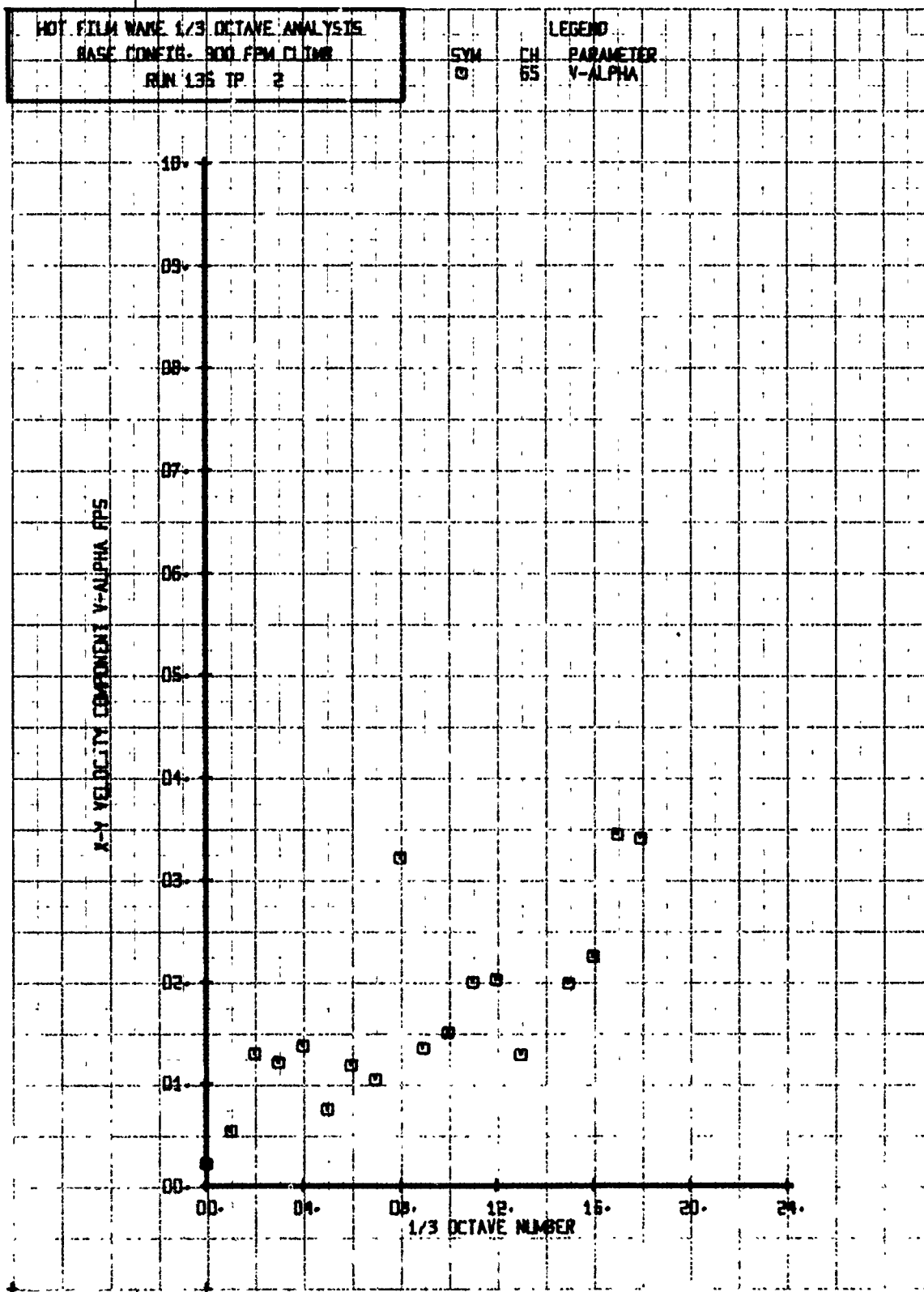
PARAMETER

BETA

LATERAL FLAM ANGLE, BETA - DEGREES







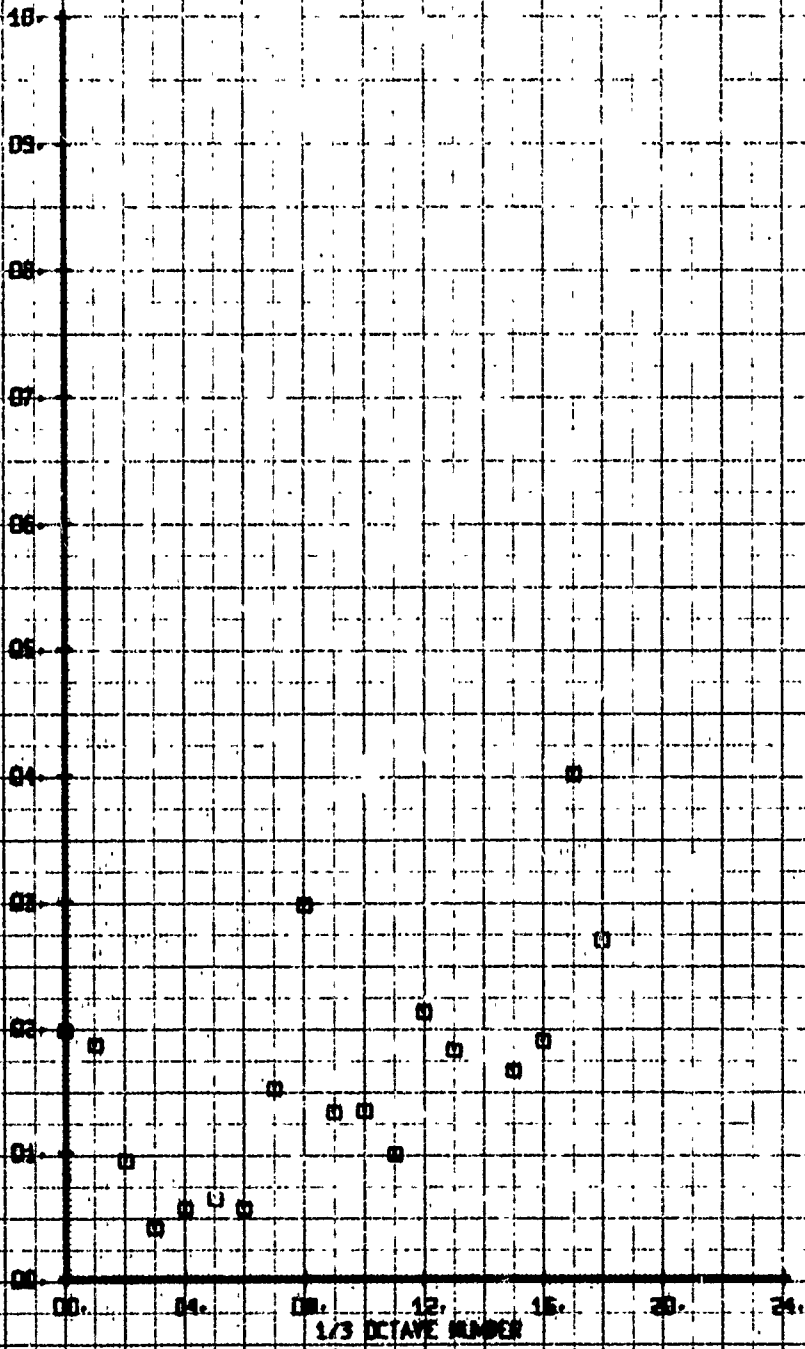
HOT FILM WAKE 1/3 OCTAVE ANALYSIS  
 BASE CONFIG. 900 FPM CLIMB  
 RUN 135 TP 4

SYM  
 □

CH  
 65

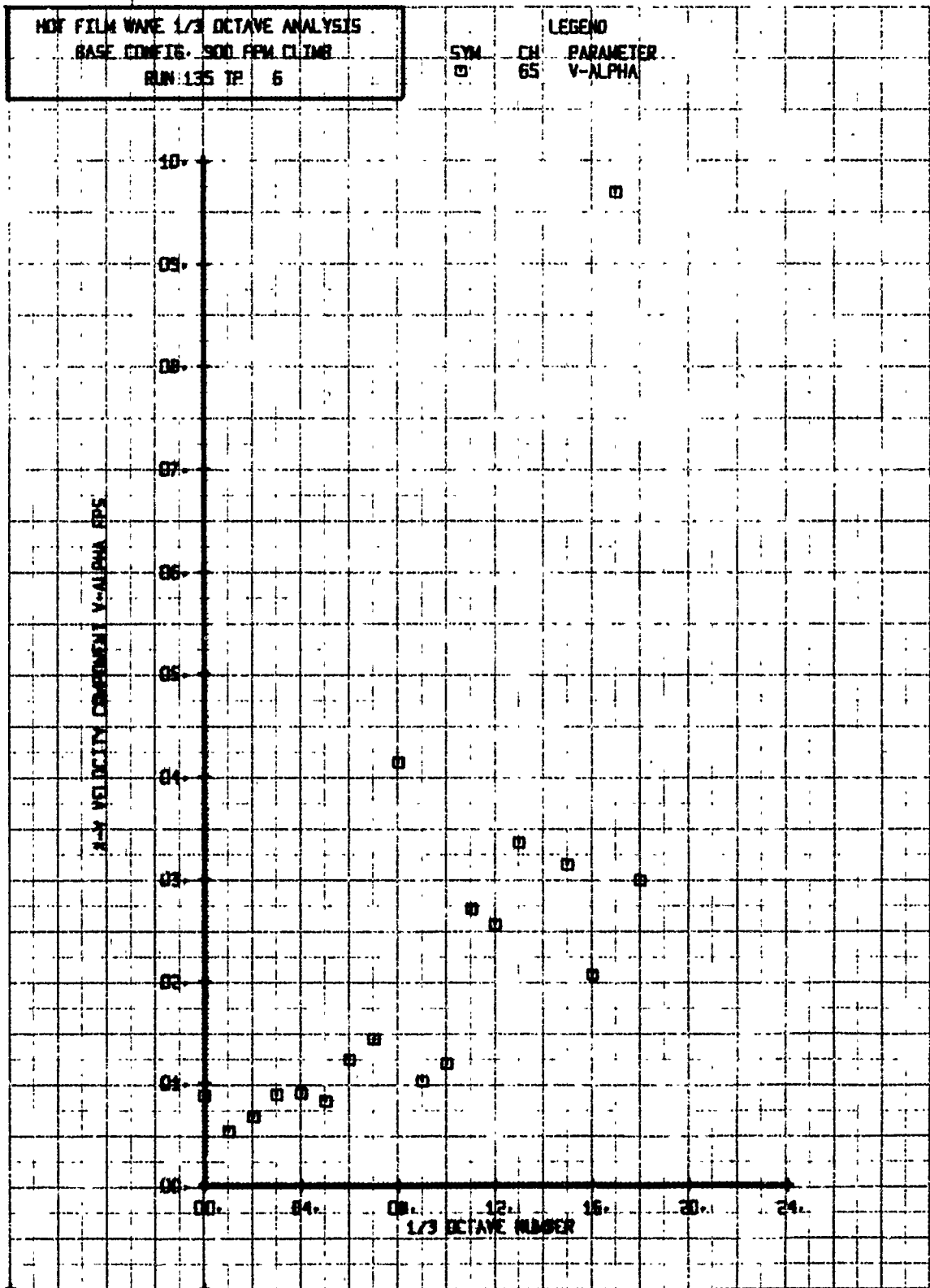
LEGEND  
 PARAMETER  
 V-ALPHA

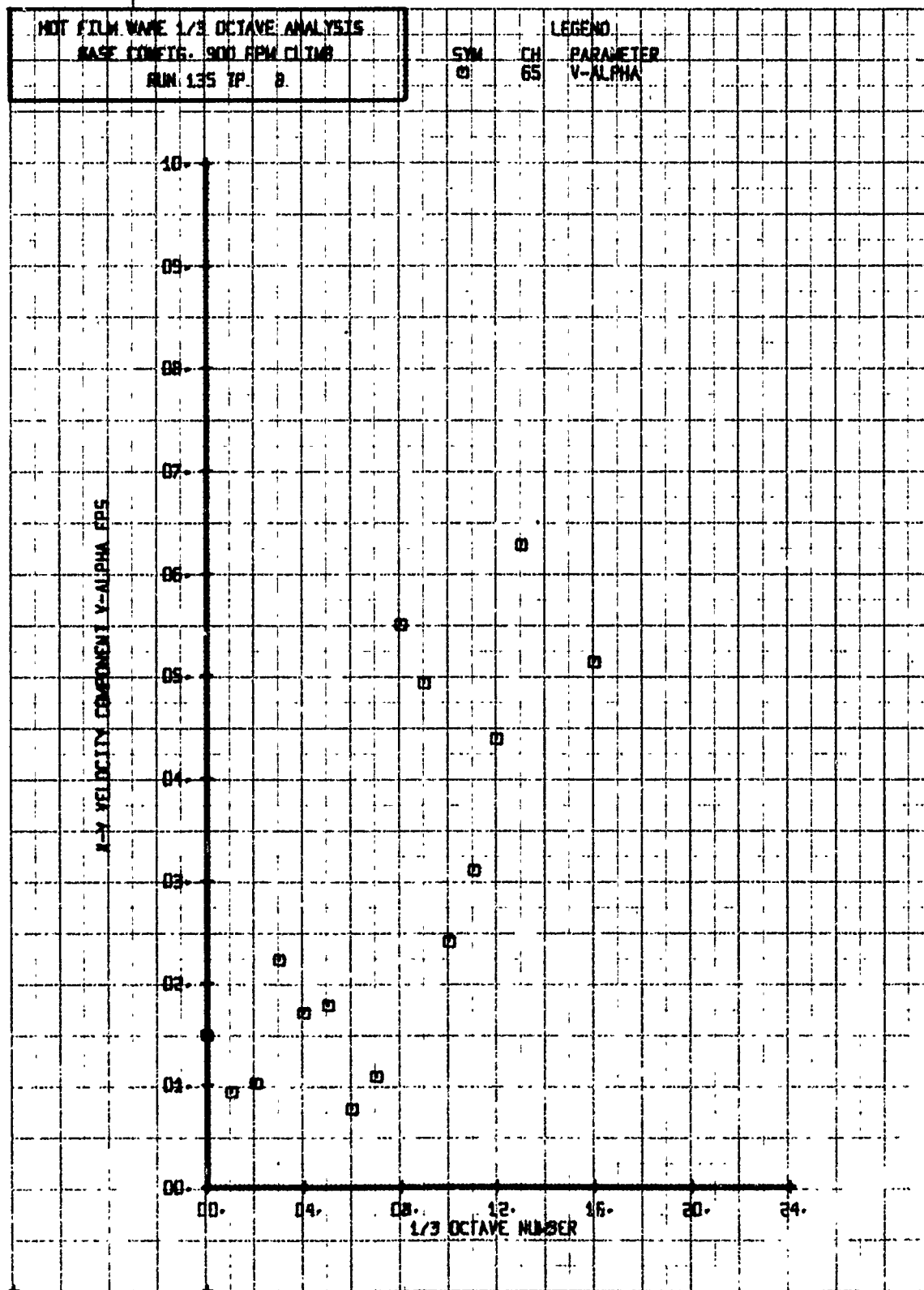
V-ALPHA COMPONENT V-ALPHA FPS

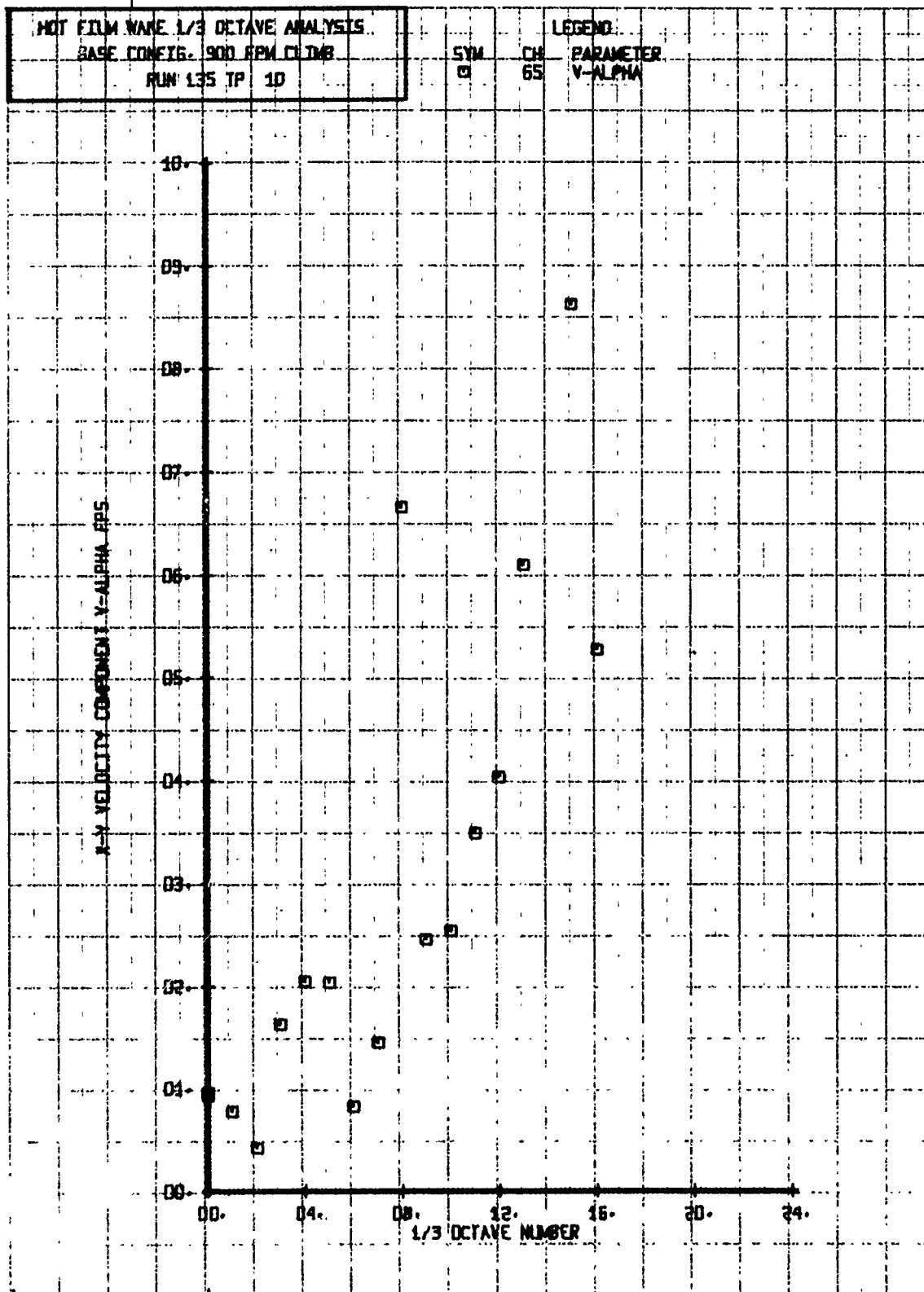


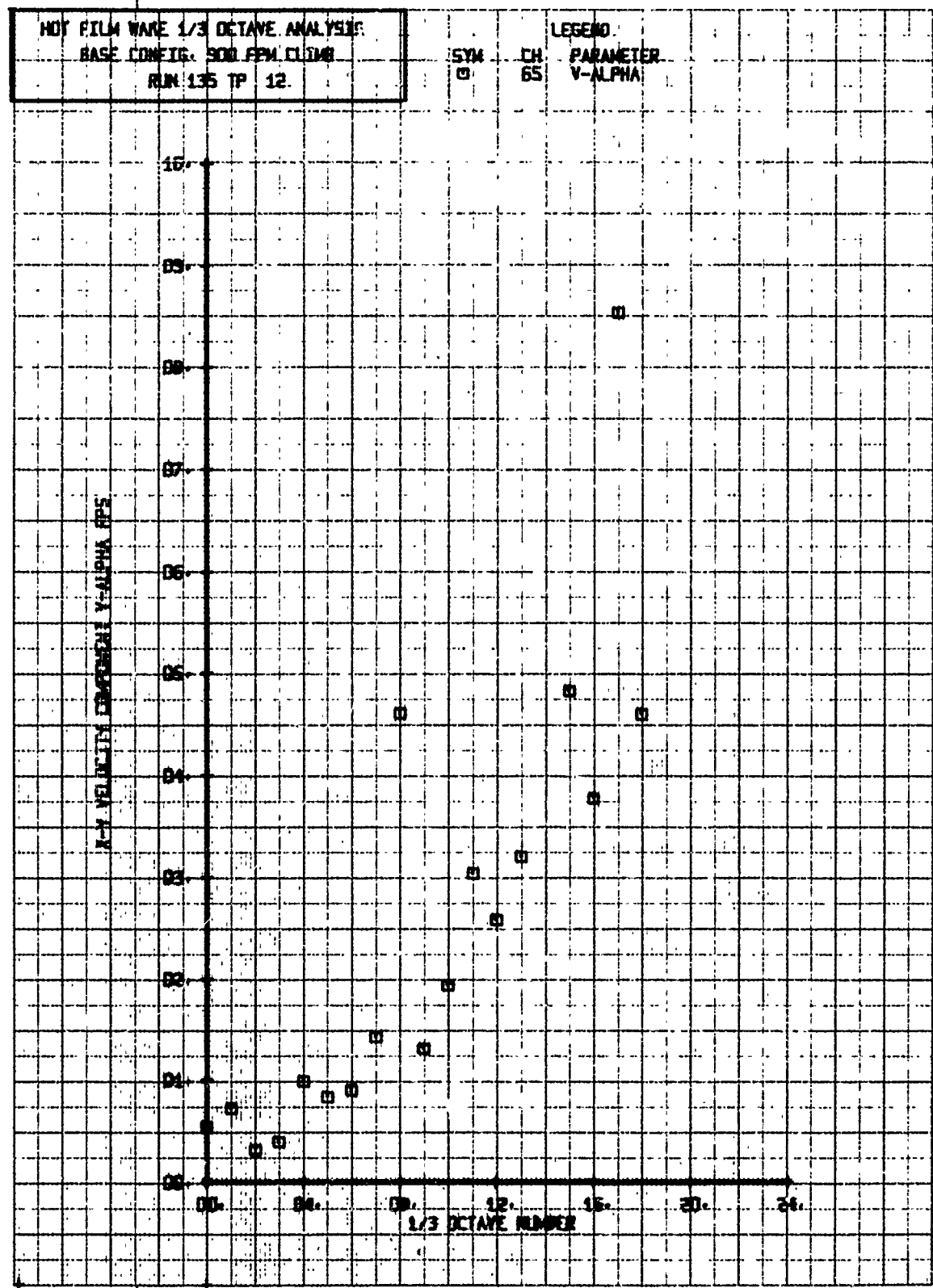
HOT FILM WAKE 1/3 OCTAVE ANALYSIS  
 BASE CONFIG. 500 RPM CLIMB  
 RUN 135 TP 6

SYM CH PARAMETER  
 □ 65 V-ALPHA







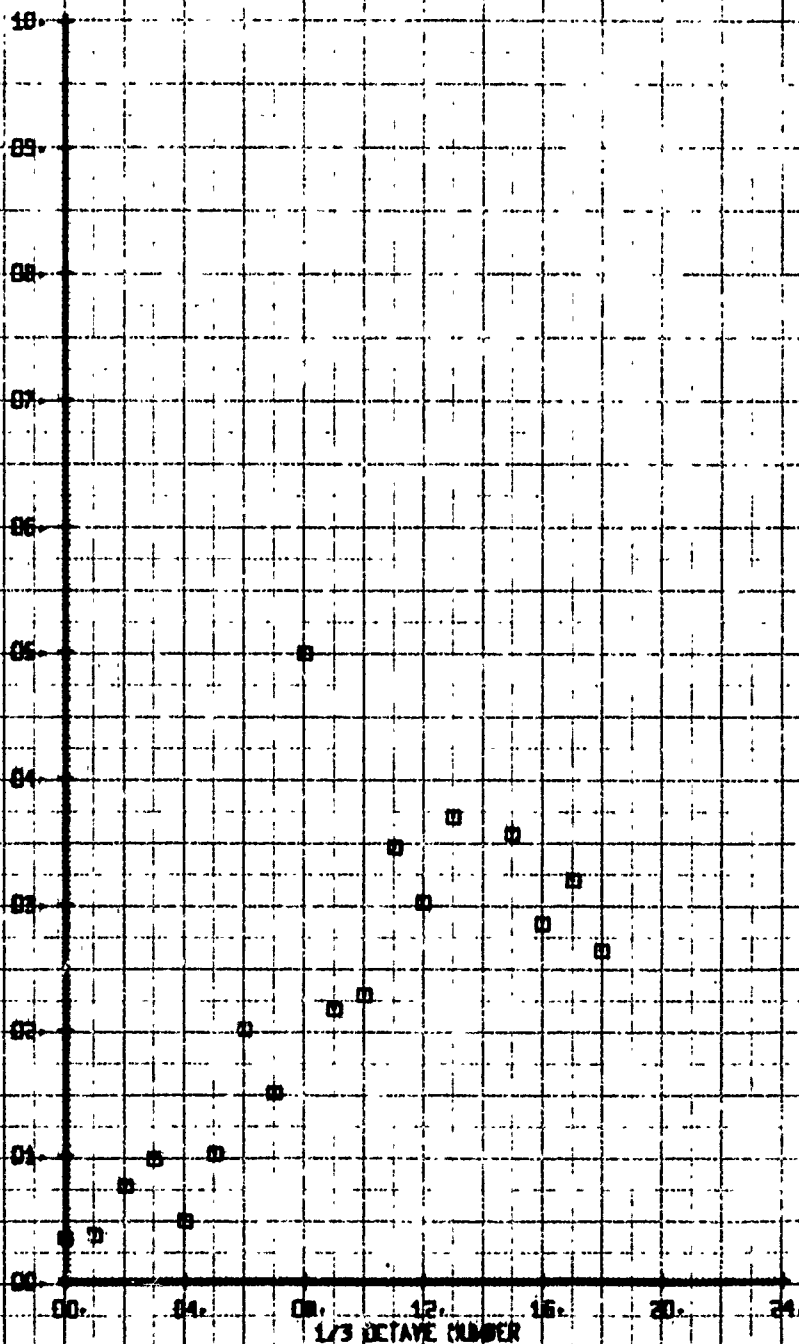


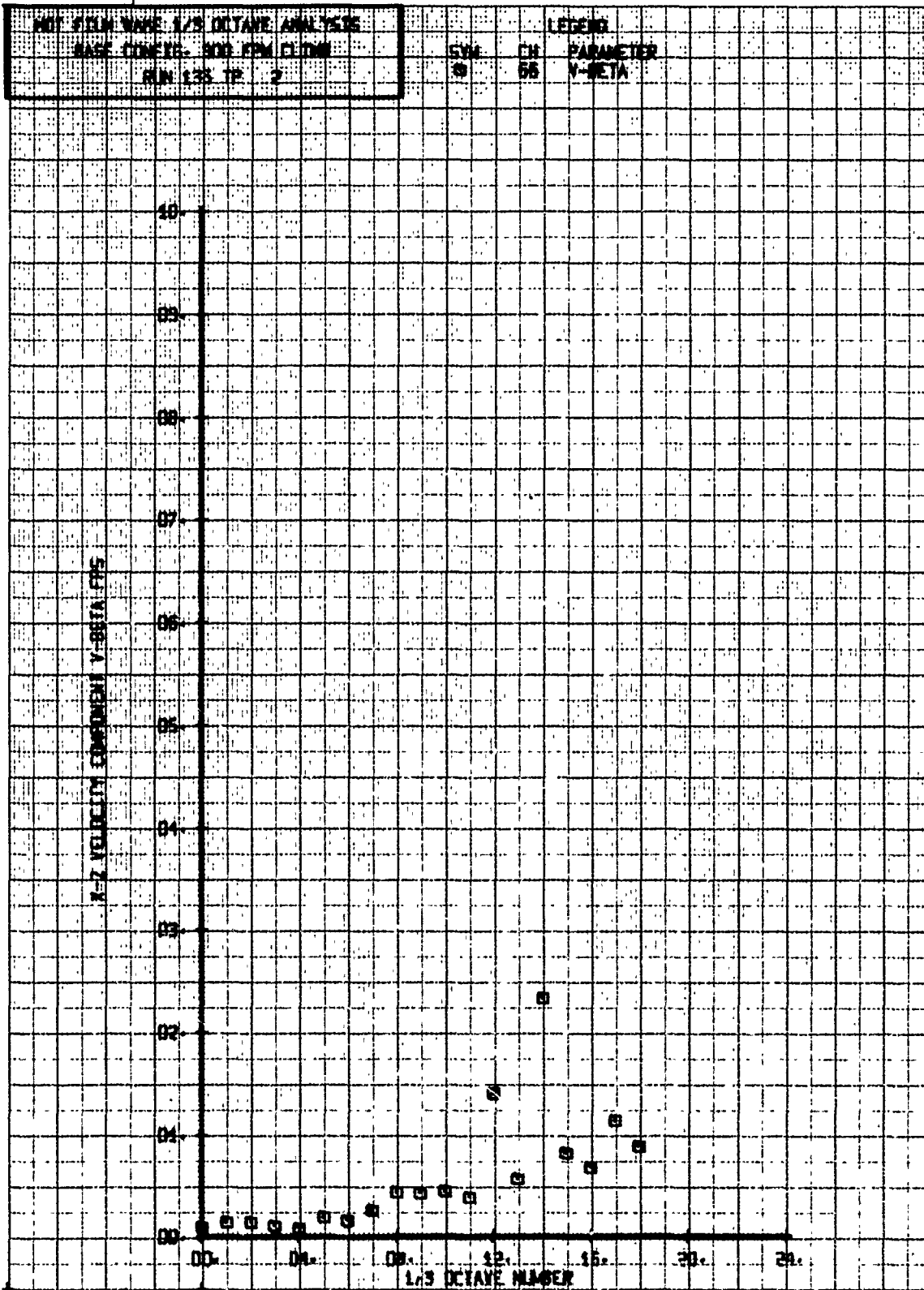


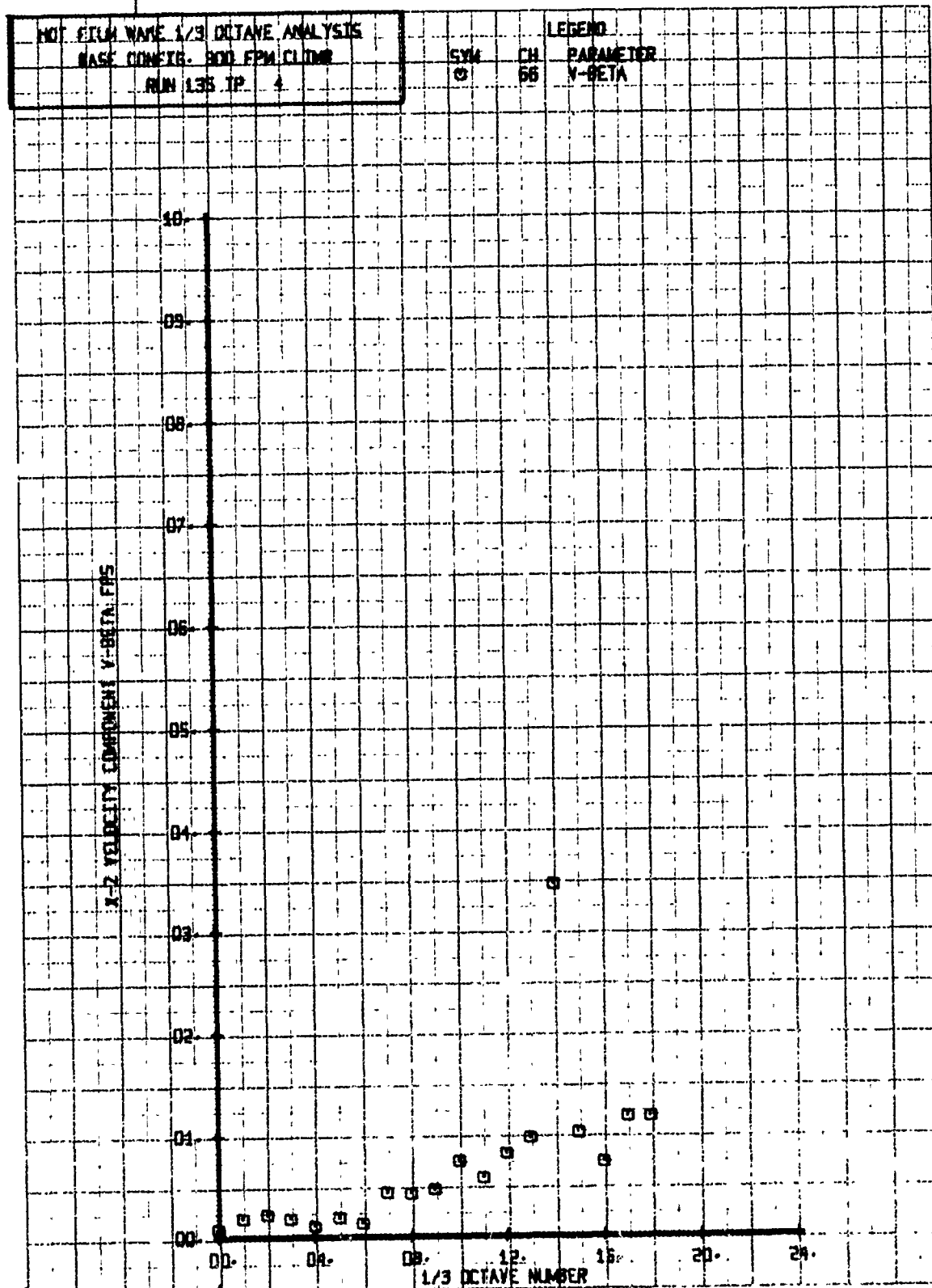
HOT FILM WAVE 1/3 OCTAVE ANALYSIS  
 BASE CONFIG. 900 FPM CLIMB  
 RUN 135 TP 14

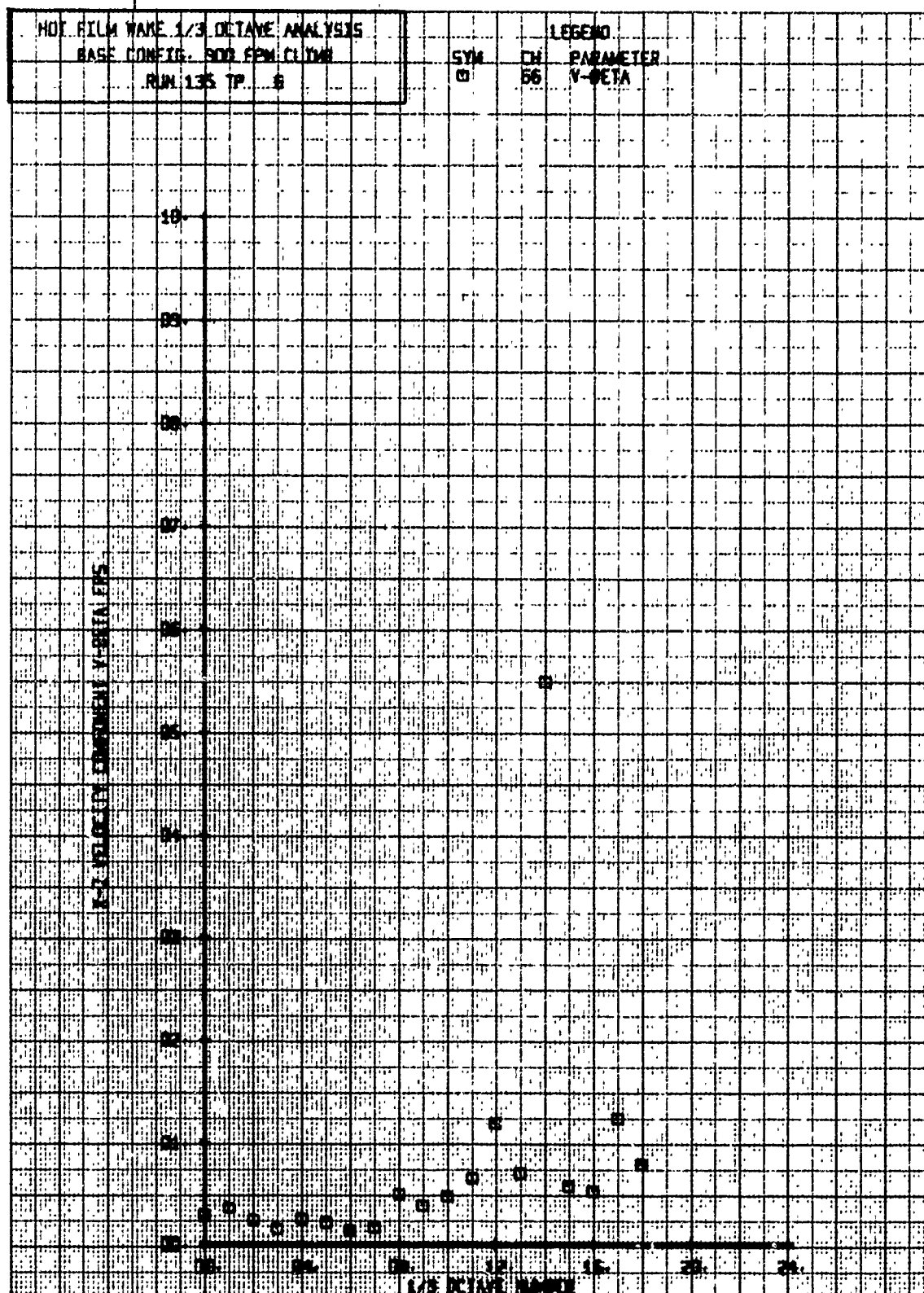
SYN CH PARAMETER  
 0 65 V-ALPHA

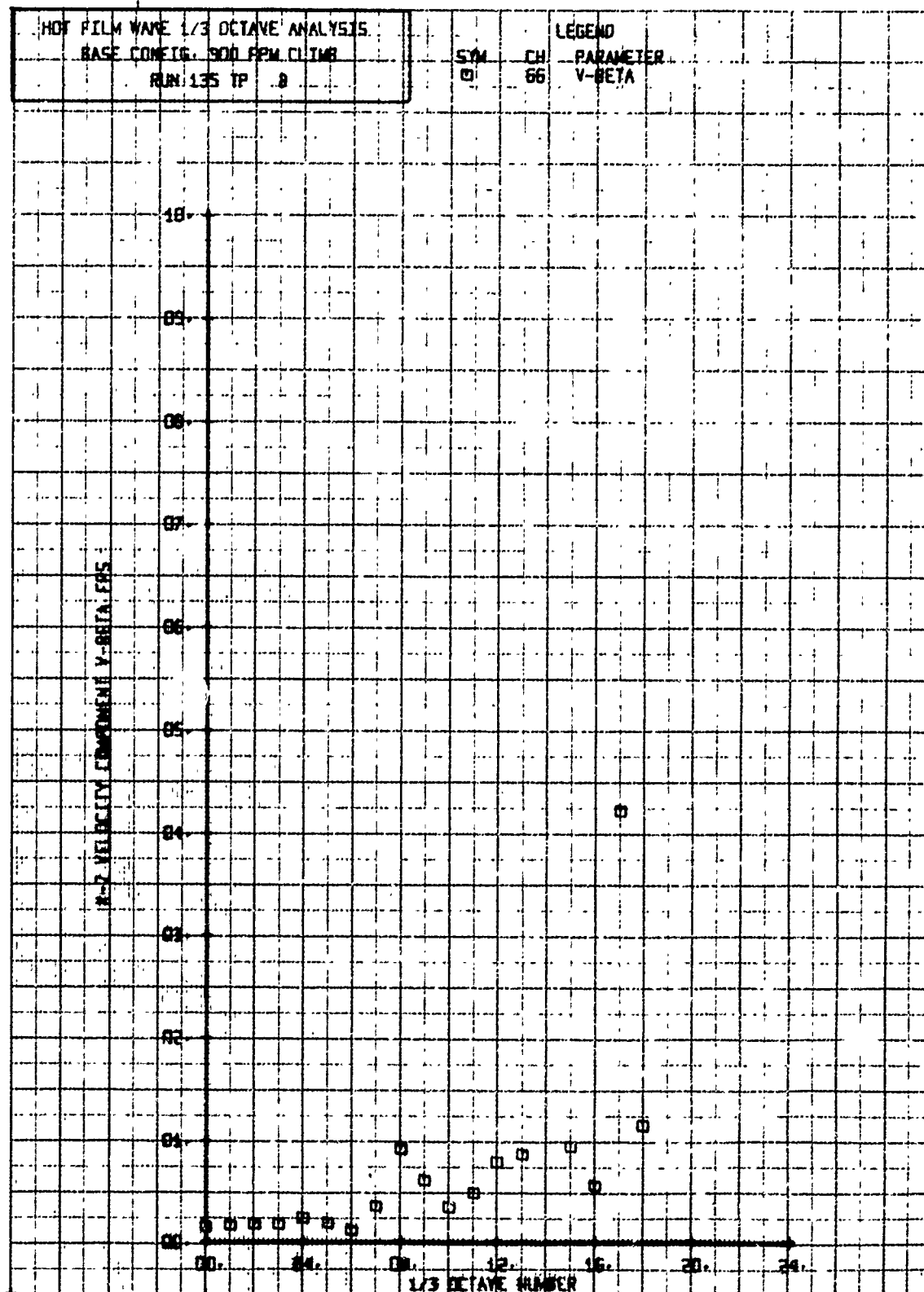
WAVE VELOCITY COMPONENT V-ALPHA RMS

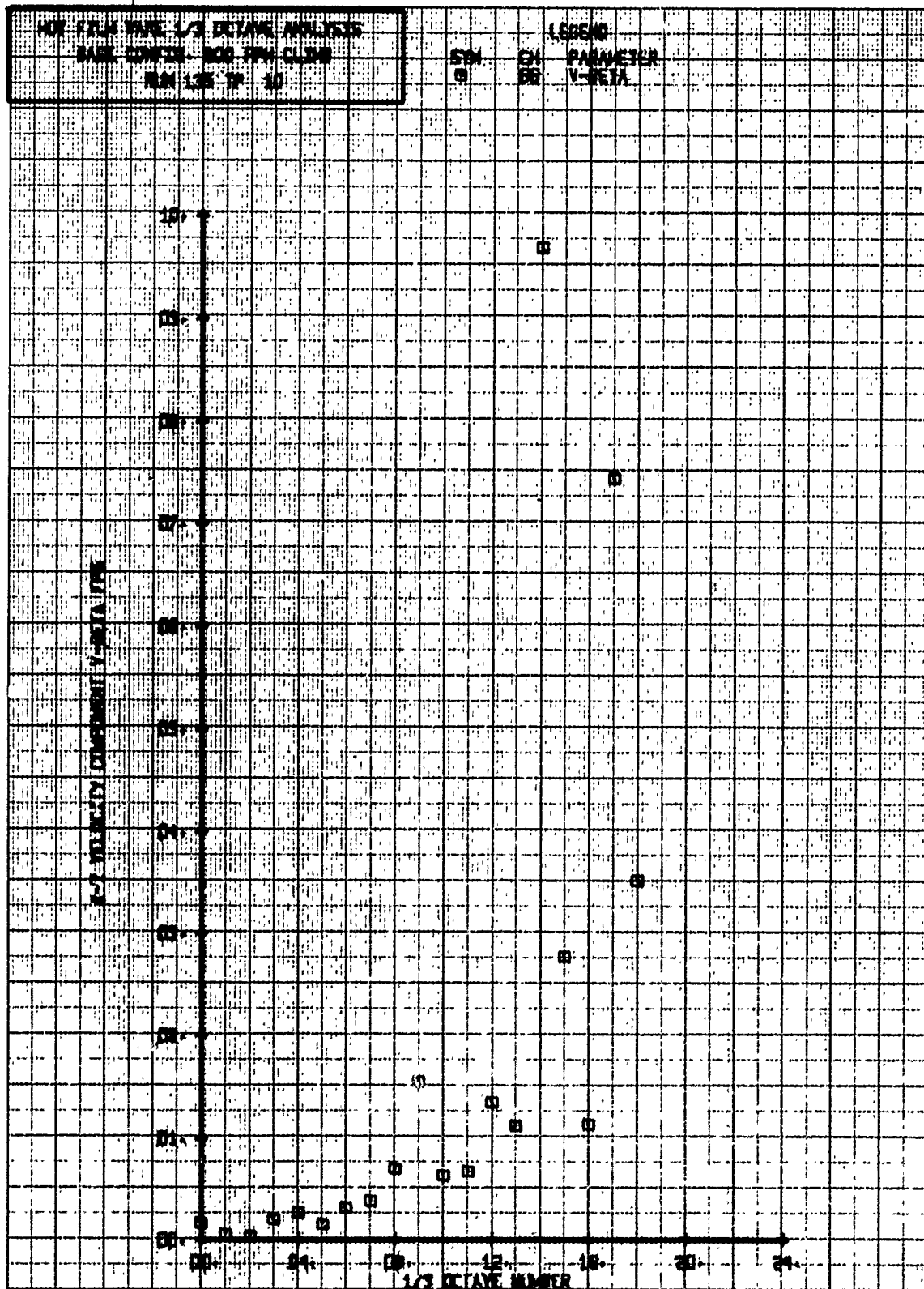










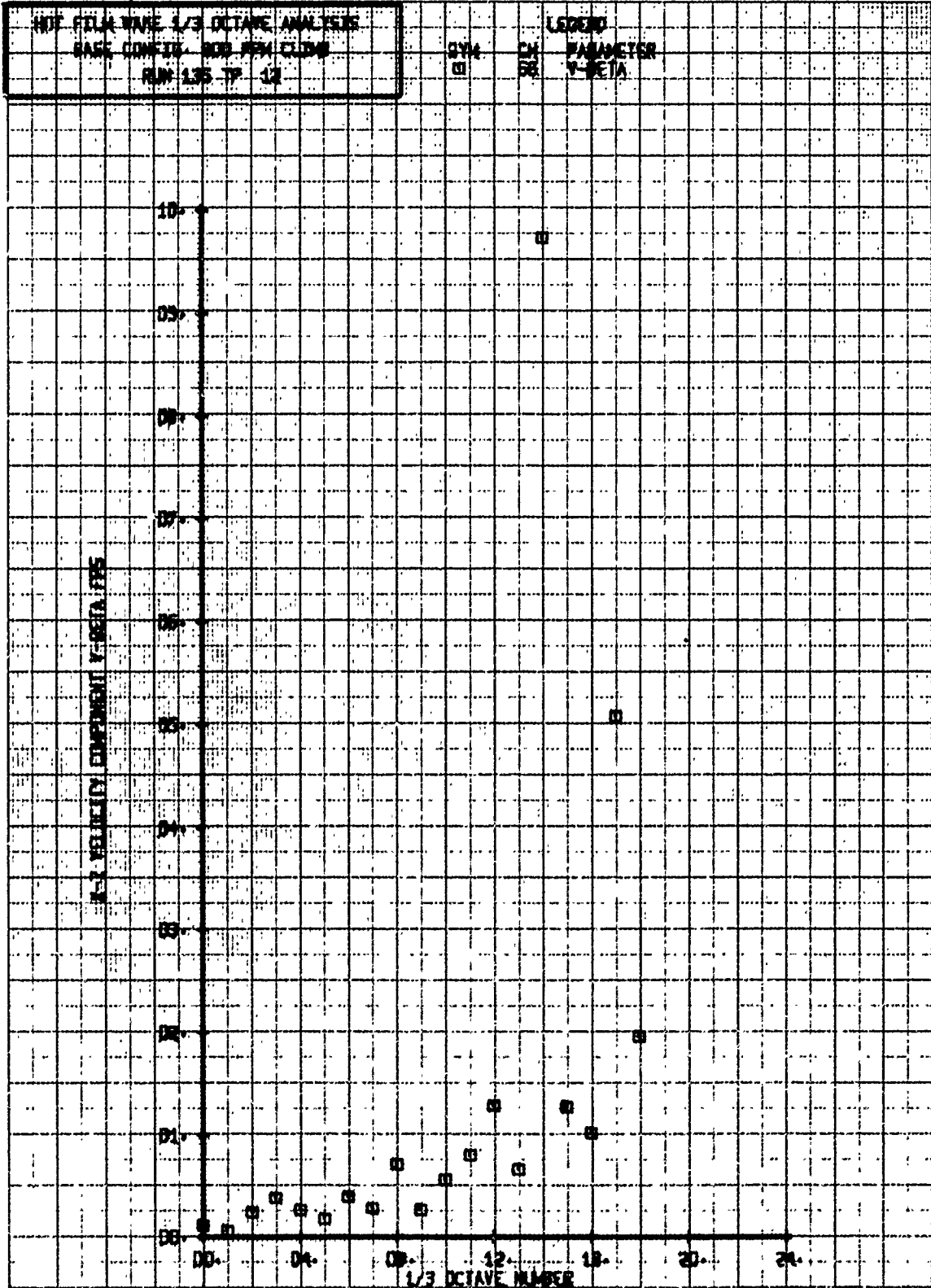


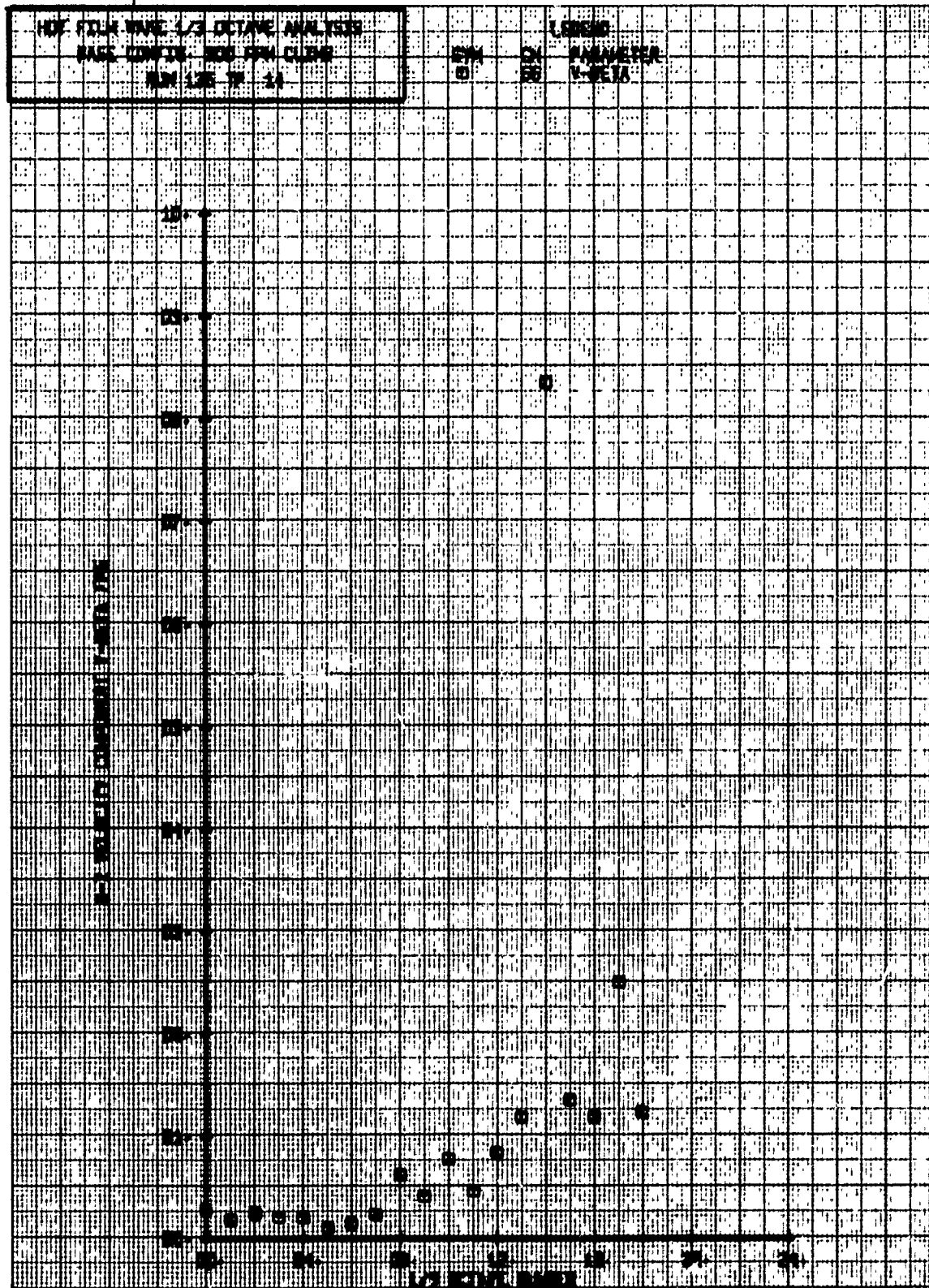
HPF FILM WAVE 1/3 OCTAVE ANALYSIS  
 BASE CONTIN. RED FROM FILM  
 RUN 135 TP 12

034  
 01

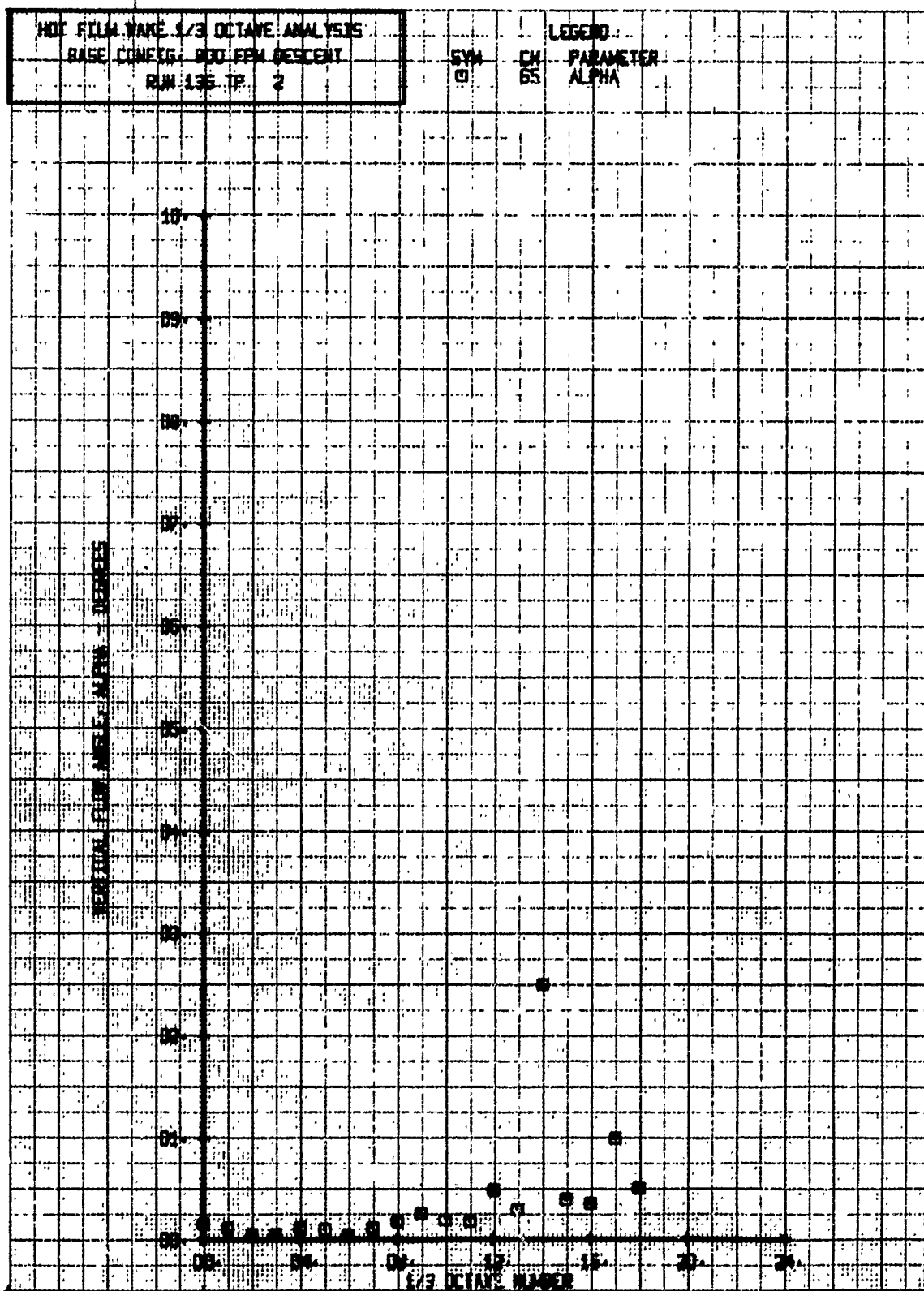
CH  
 58

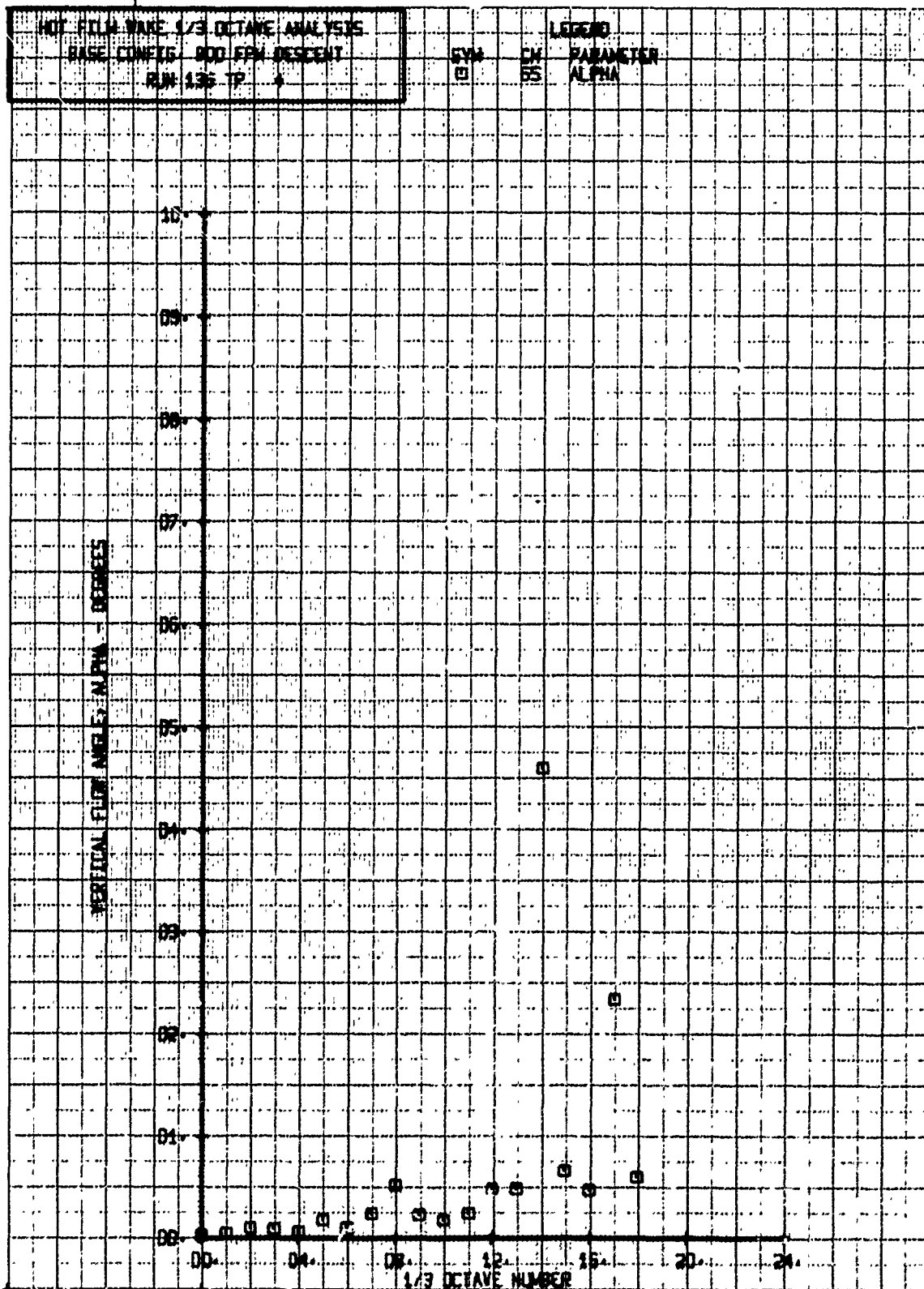
LS000  
 PARAMETER  
 V-BETA

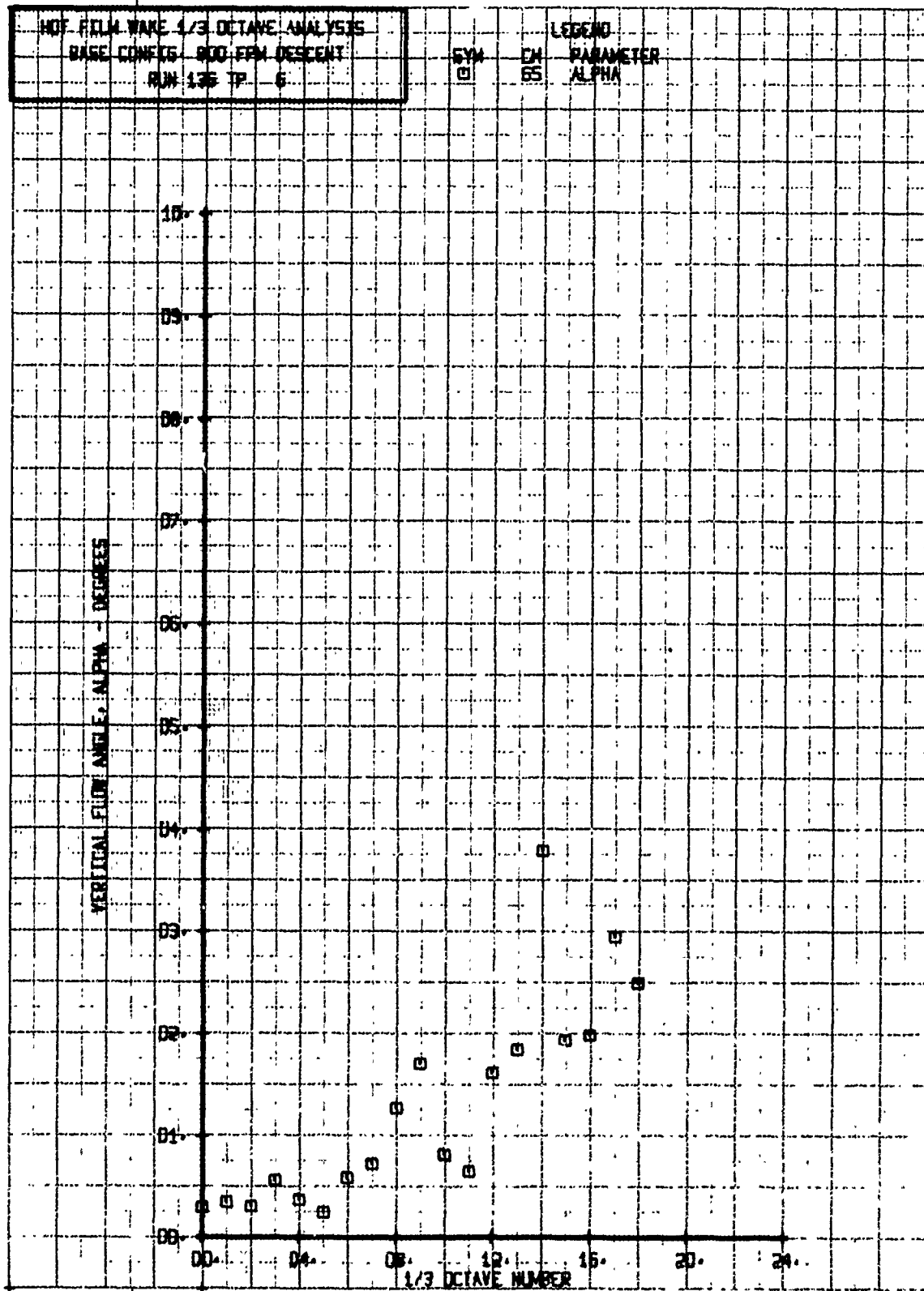


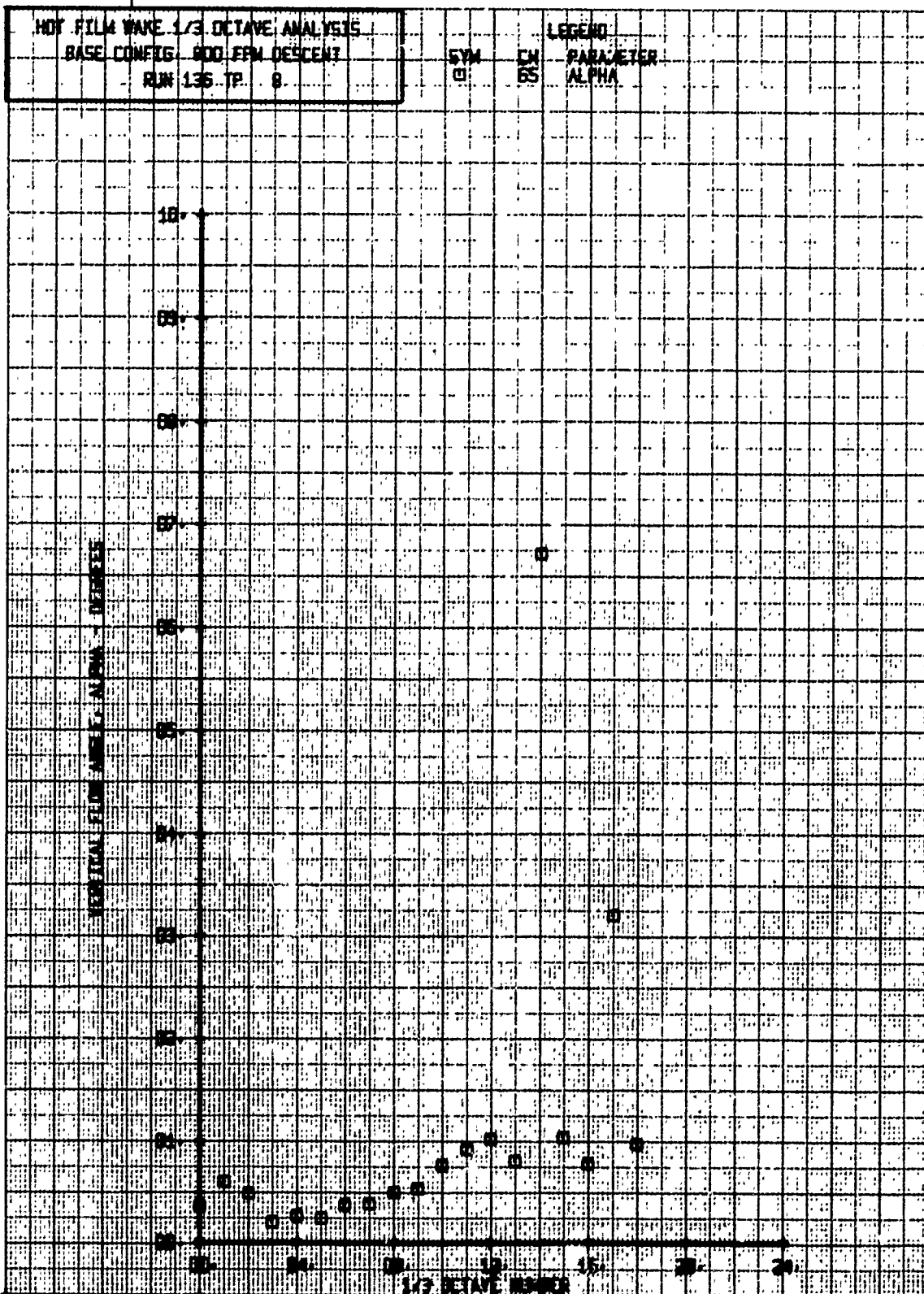










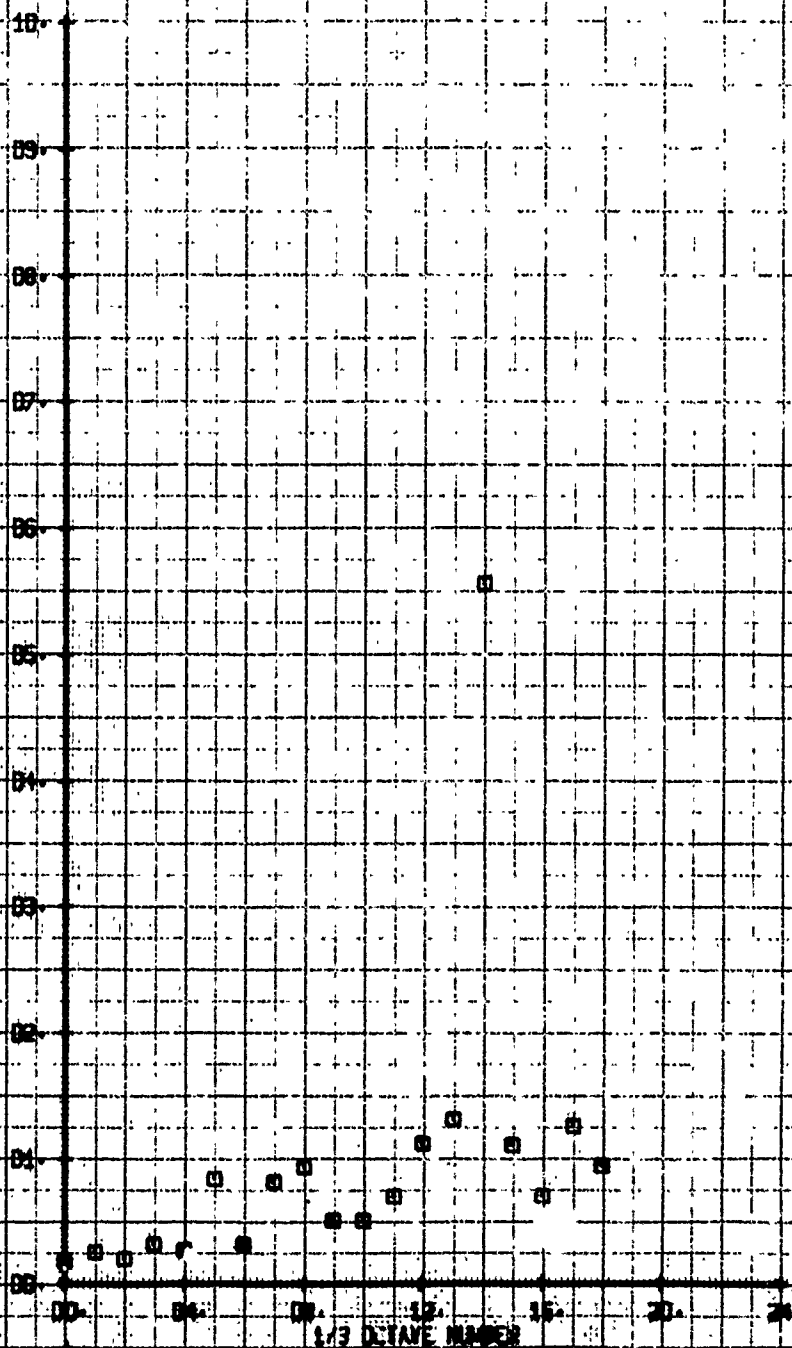


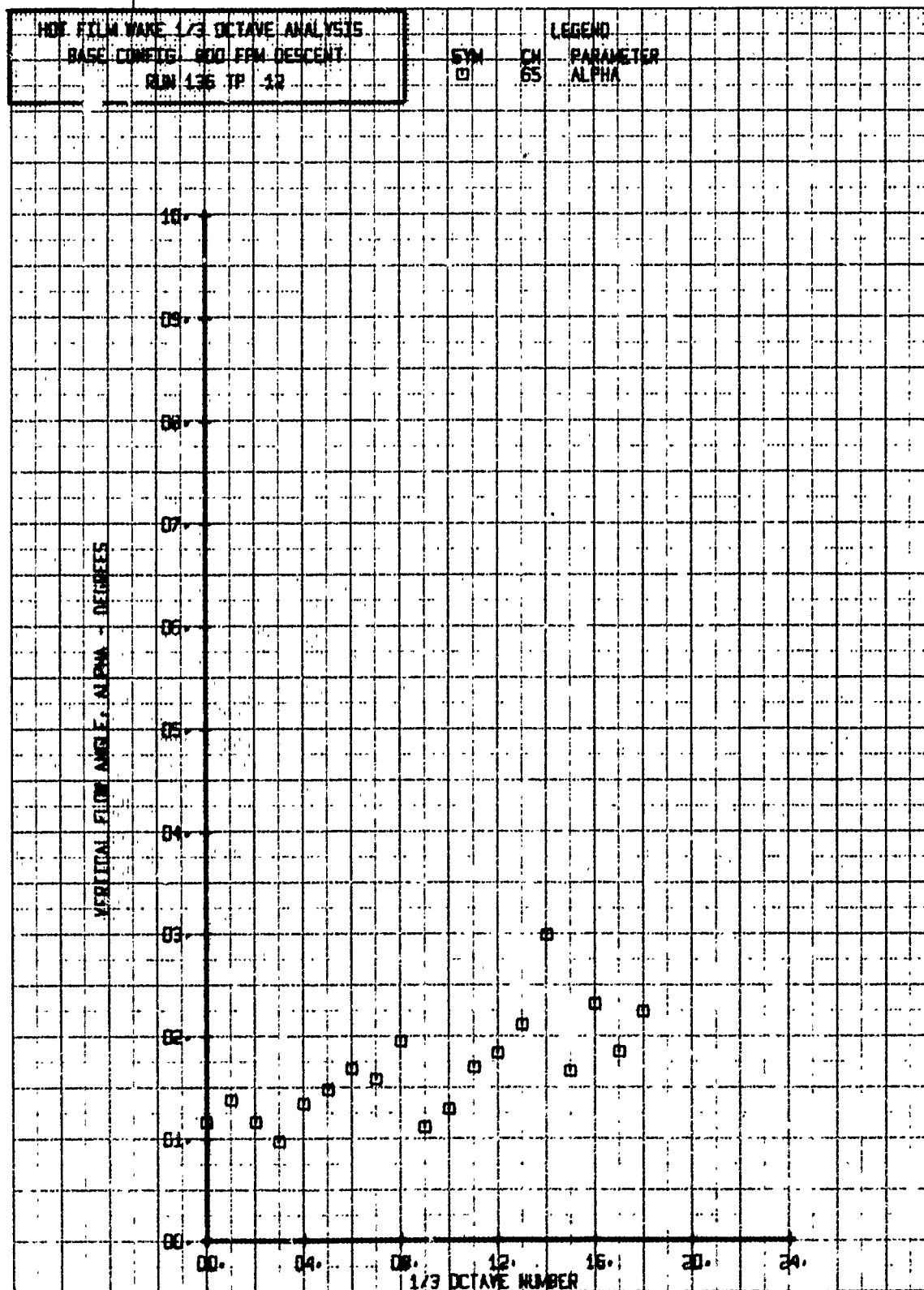
HOI FILM WAKE 1/3 OCTAVE ANALYSIS  
 BASE CONFIG. 800 FPM DESCENT  
 RUN 136 TP 10

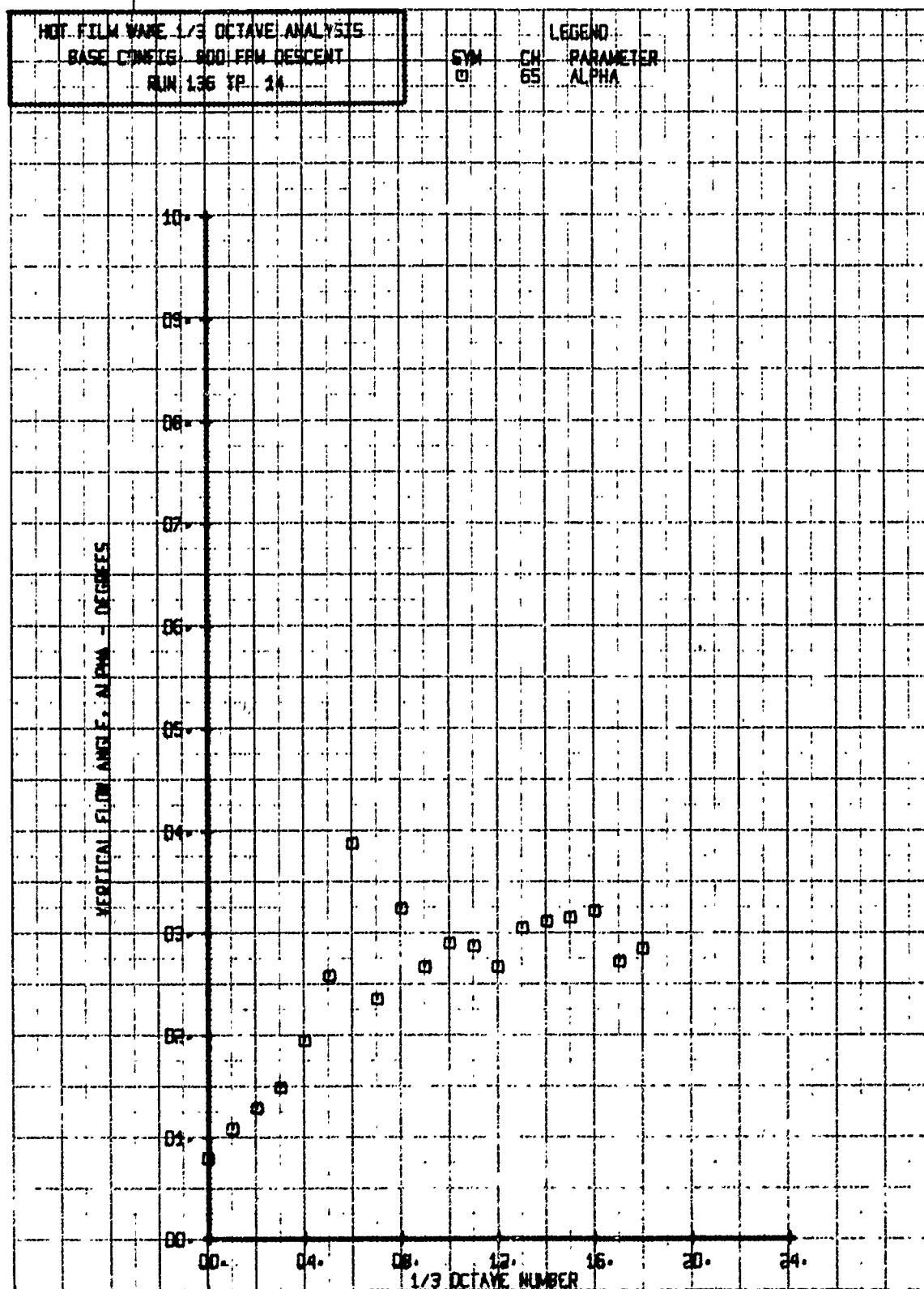
SYM  
 0

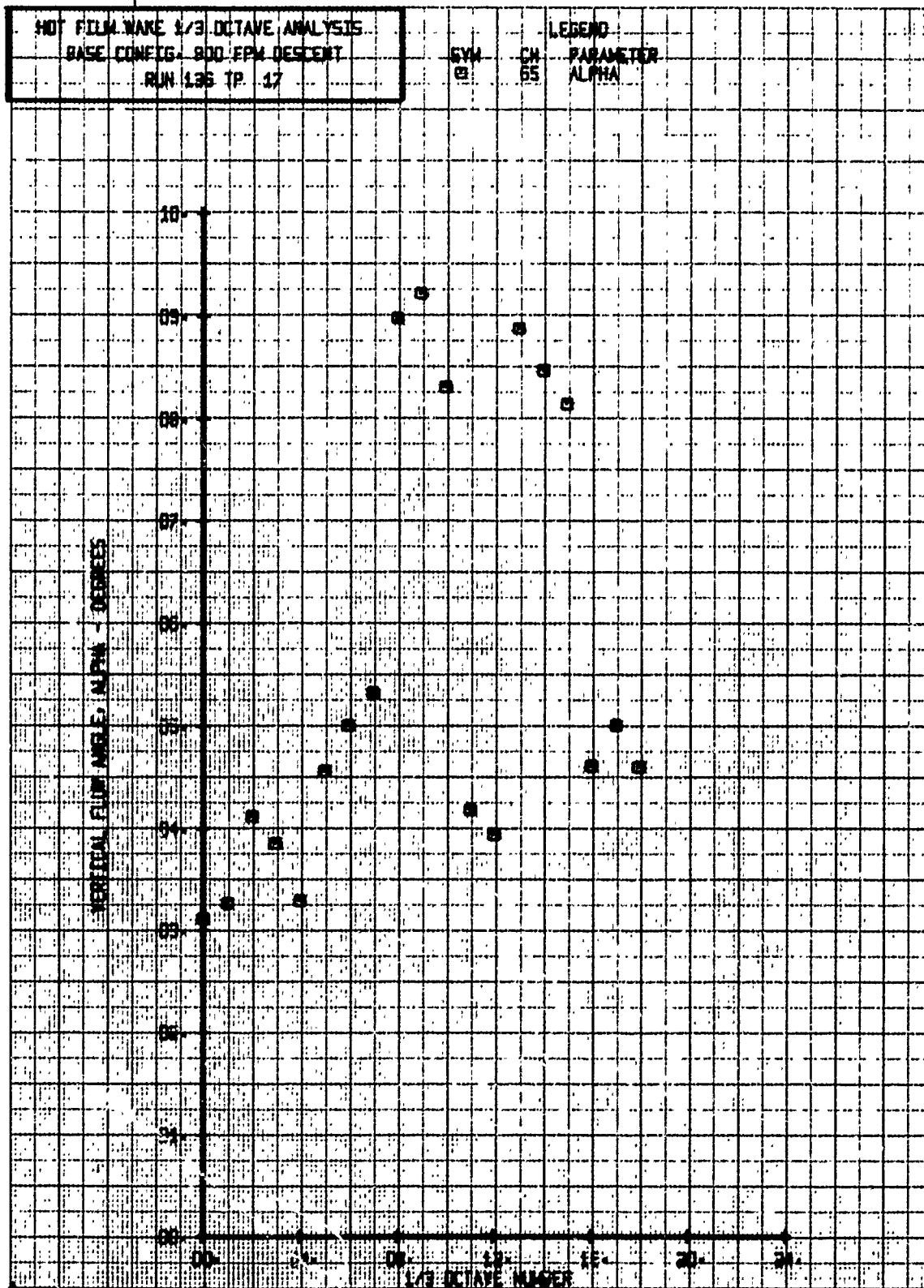
LEGEND  
 CH 65 - PARAMETER  
 ALPHA

VERTICAL FILM ANGLE, ALPHA - DEGREES











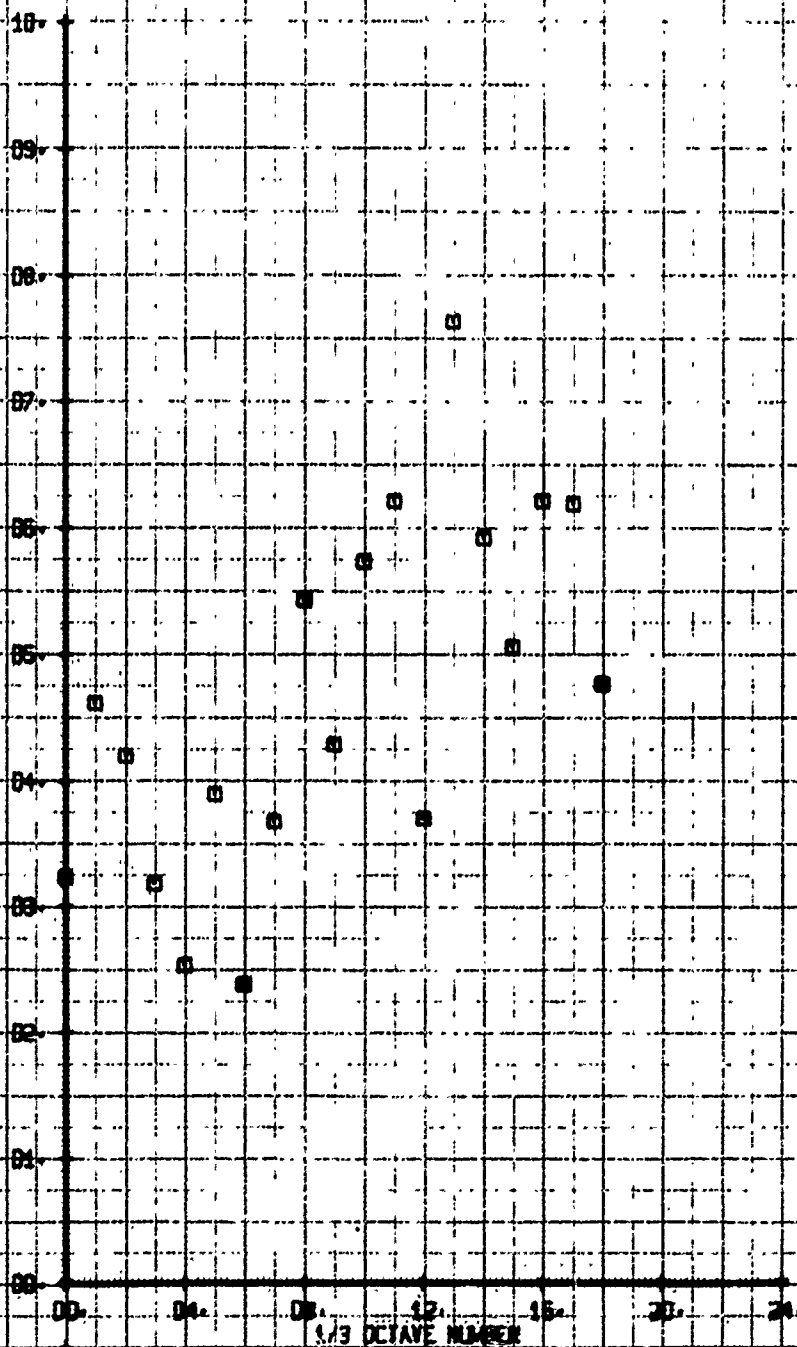
HOT FILM WAKE 1/3 OCTAVE ANALYSIS  
 BASE CONFIG. 800 FPM DESCENT  
 RUN 135 TP 18

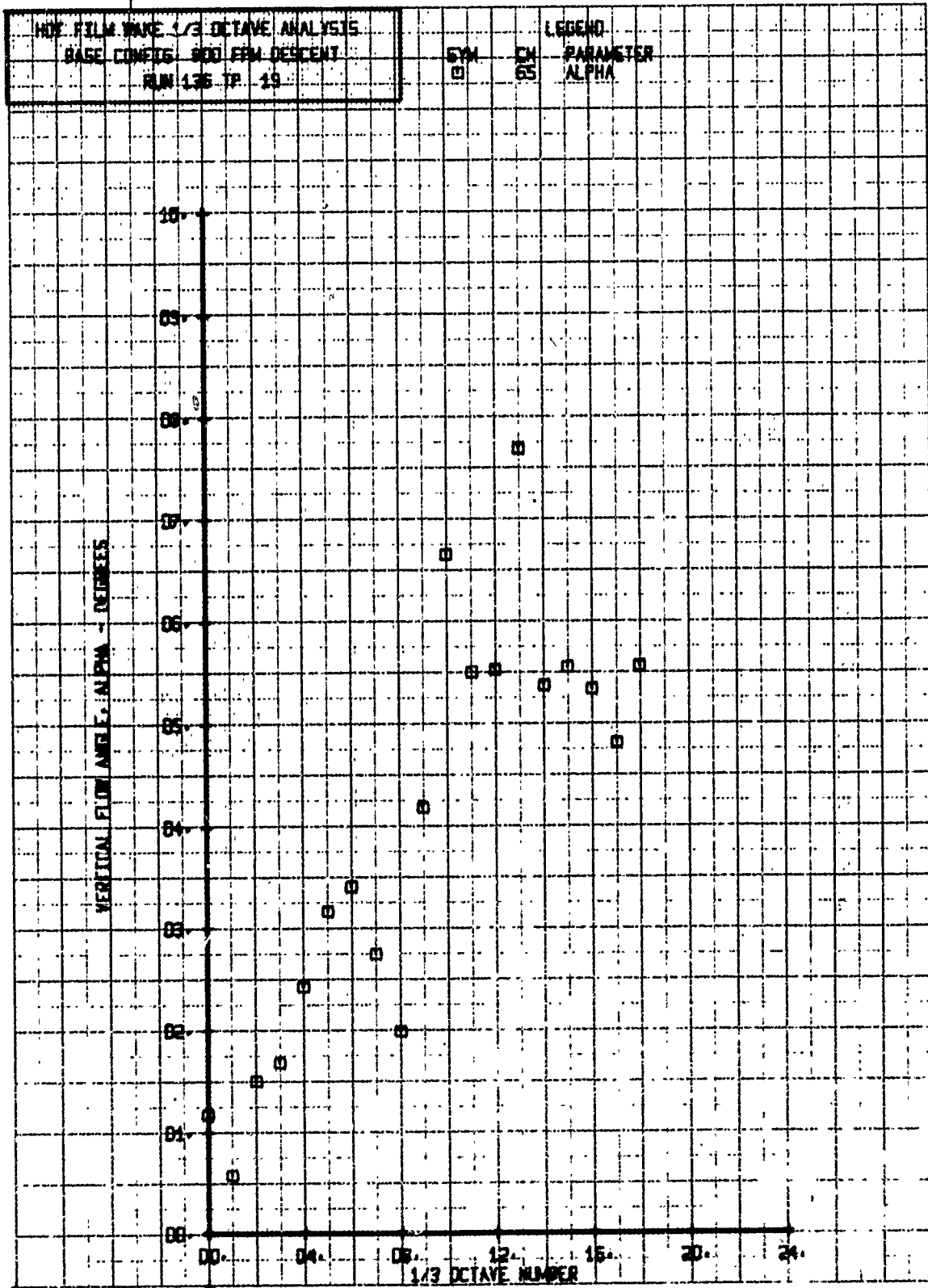
SYM  
 □

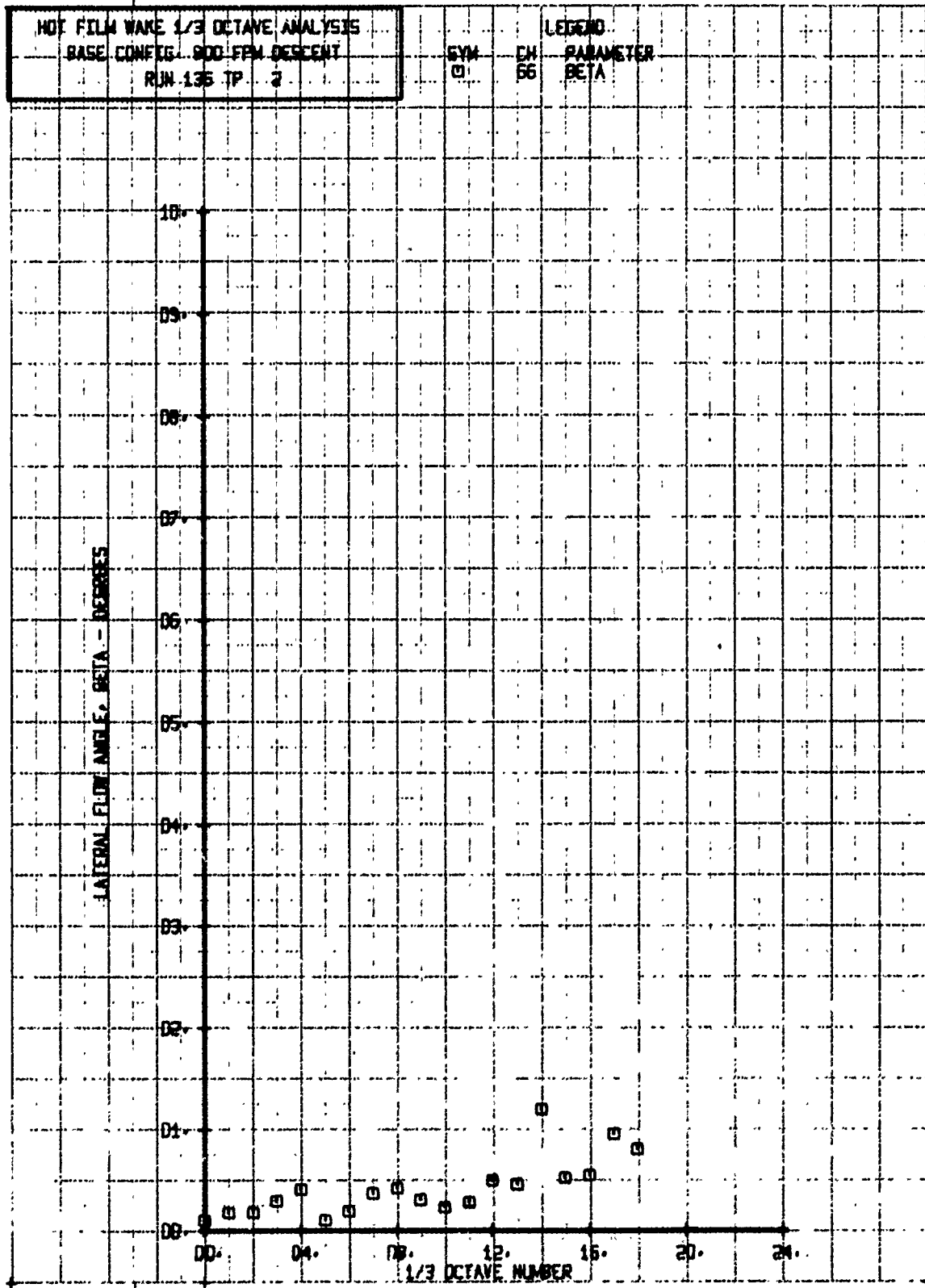
CH  
 65

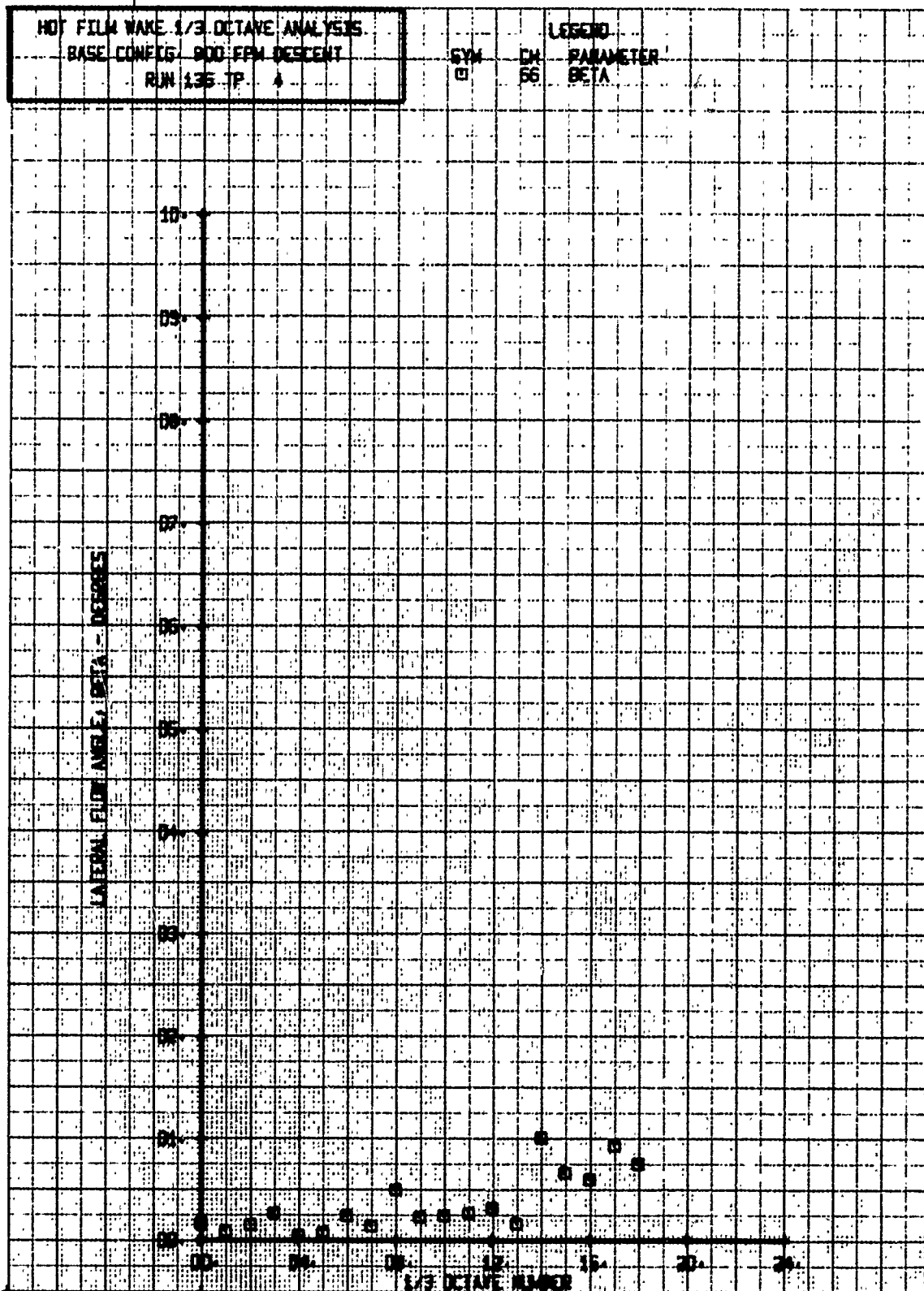
LEGEND  
 PARAMETER  
 ALPHA

VERTICAL FLOW ANGLE, ALPHA - DEGREES









HOT FILM WAKE 1/3 OCTAVE ANALYSIS  
 BASE CONFIG. 800 FPM DESCENT  
 RUN 136 TP 6

SYM  
 □

CH  
 66

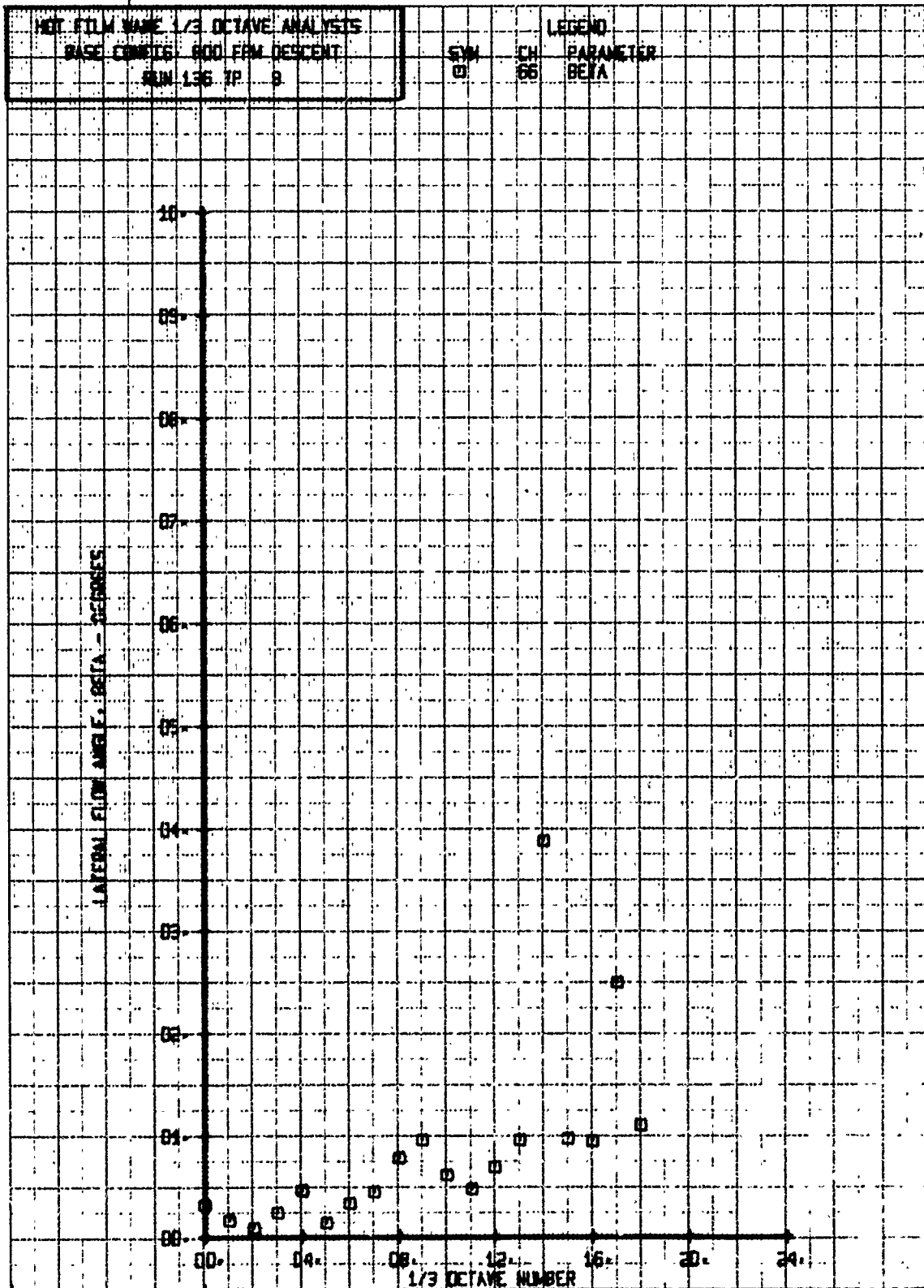
LEGEND  
 PARAMETER  
 BETA

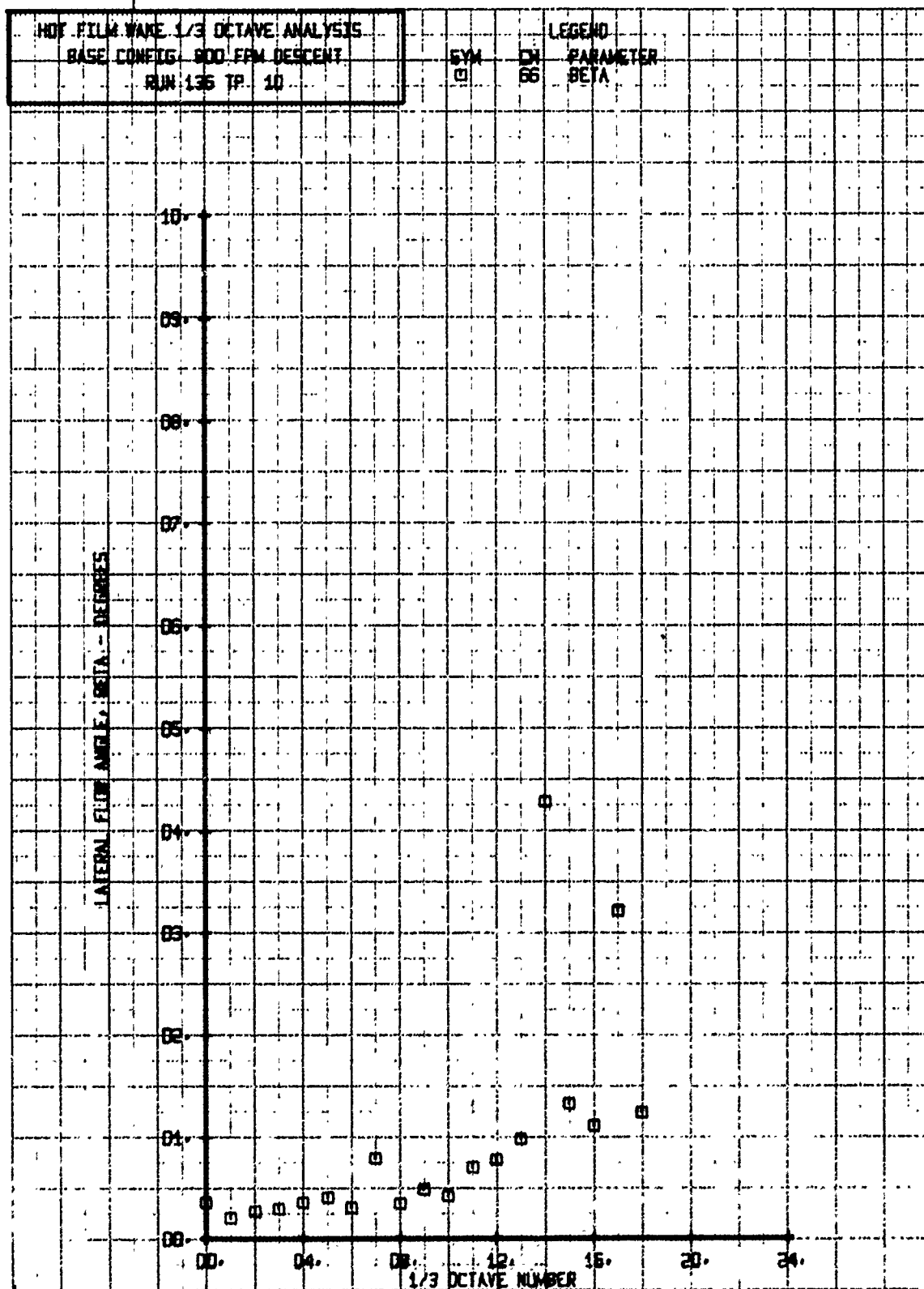
LATERAL FLUID ANGLE, BETA - DEGREES

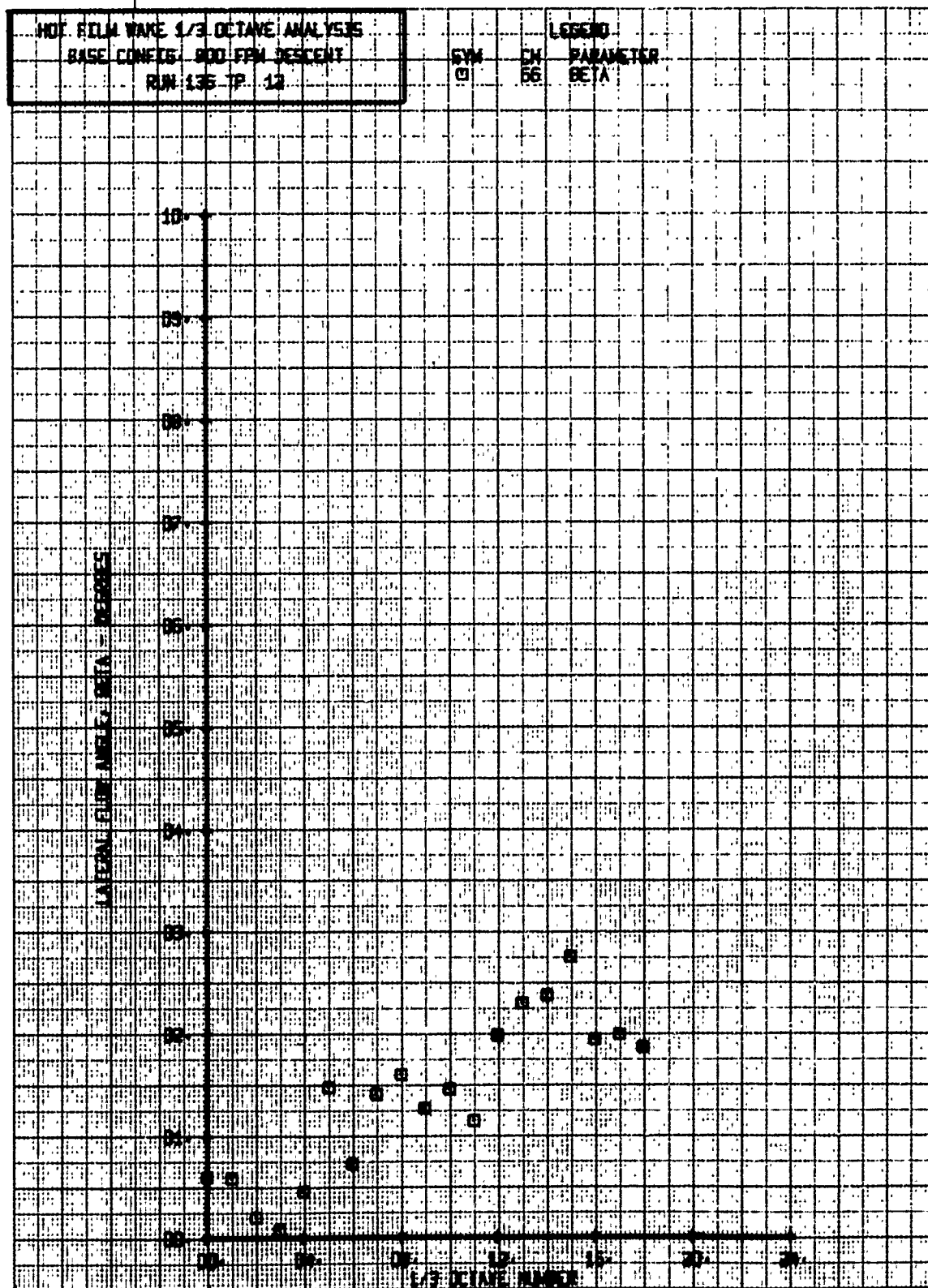
10  
 09  
 08  
 07  
 06  
 05  
 04  
 03  
 02  
 01  
 00

1/3 OCTAVE NUMBER

00 04 08 12 16 20 24









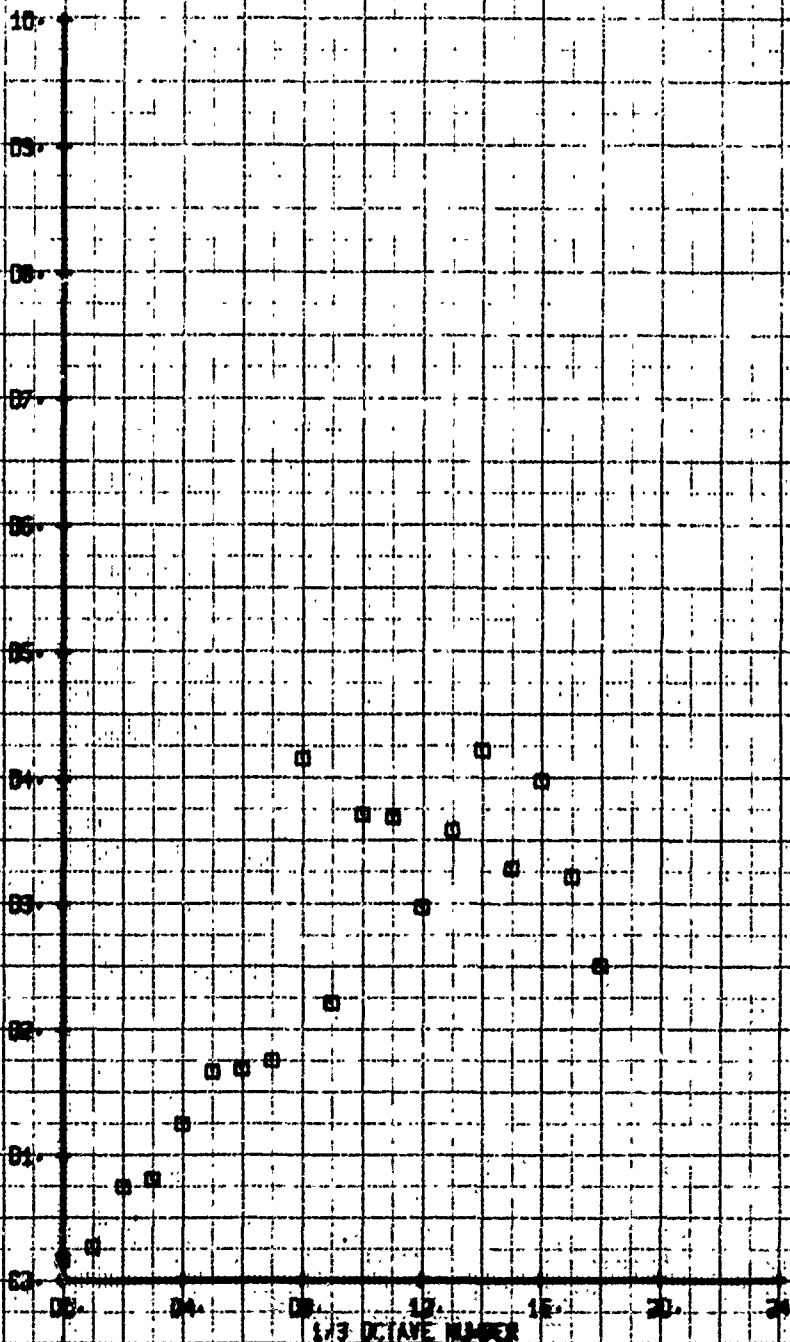
HOT FILM WAKE 1/3 OCTAVE ANALYSIS  
 BASE CONFIG. 800 FPM DESCENT  
 RUN 135 TP. 14

SYM  
 □

CH  
 66

LEGEND  
 PARAMETER  
 BETA

LATERAL FLUID ANGLE, BETA - DEGREES



NOI FILM WAVE 1/3 OCTAVE ANALYSIS

BASE CONTIG. NOO FPM DES-ENT

RUN 135 TP 17

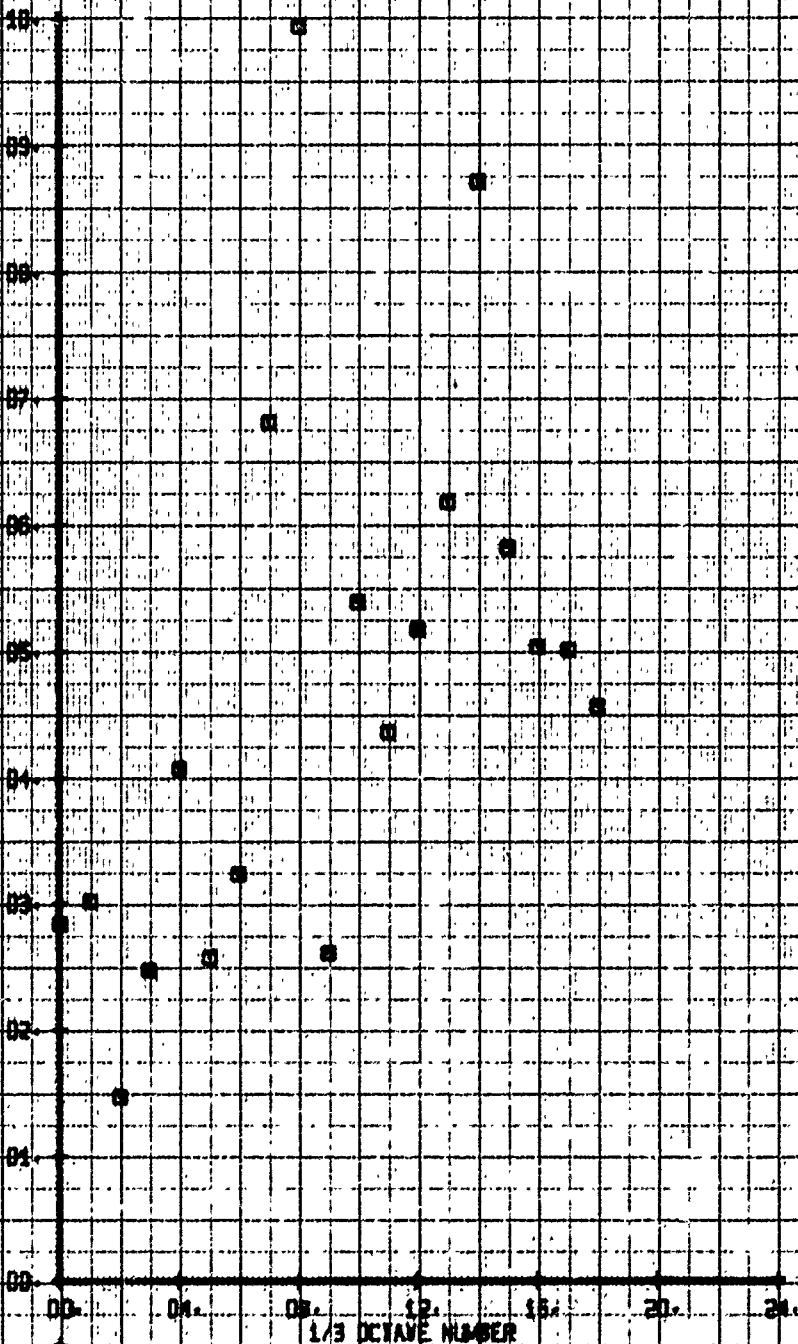
LEGEND

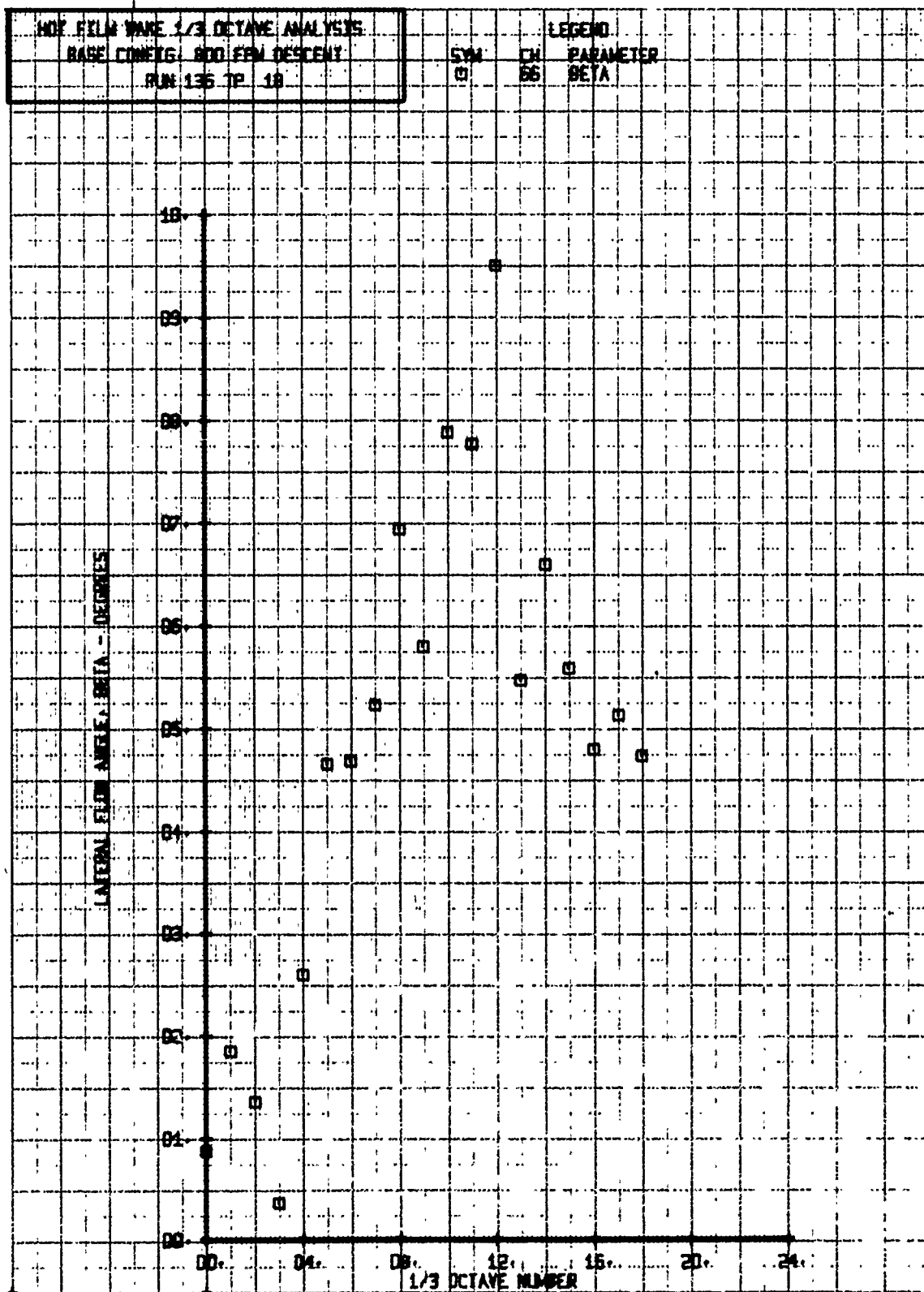
SYM  
□

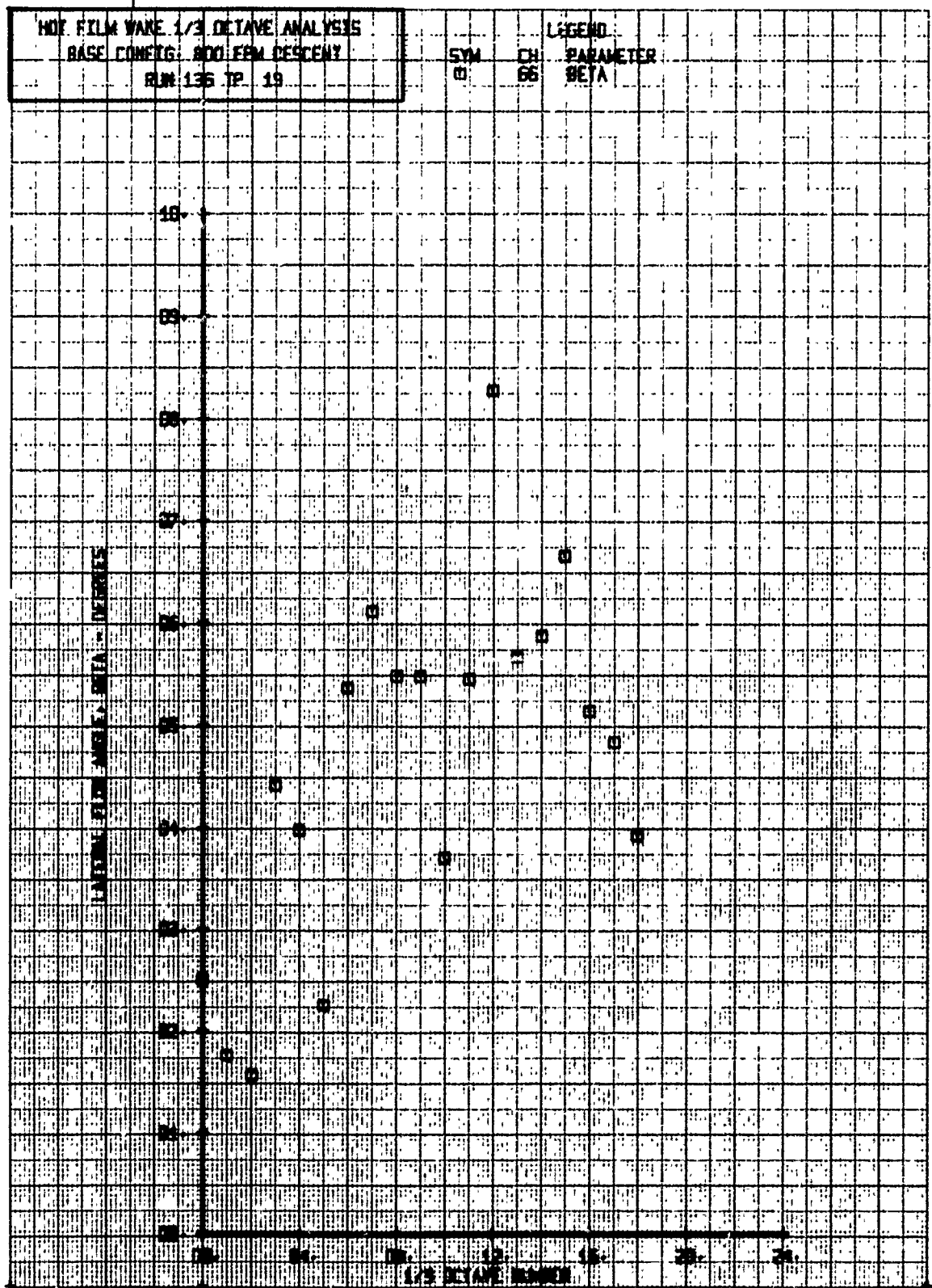
CH  
55

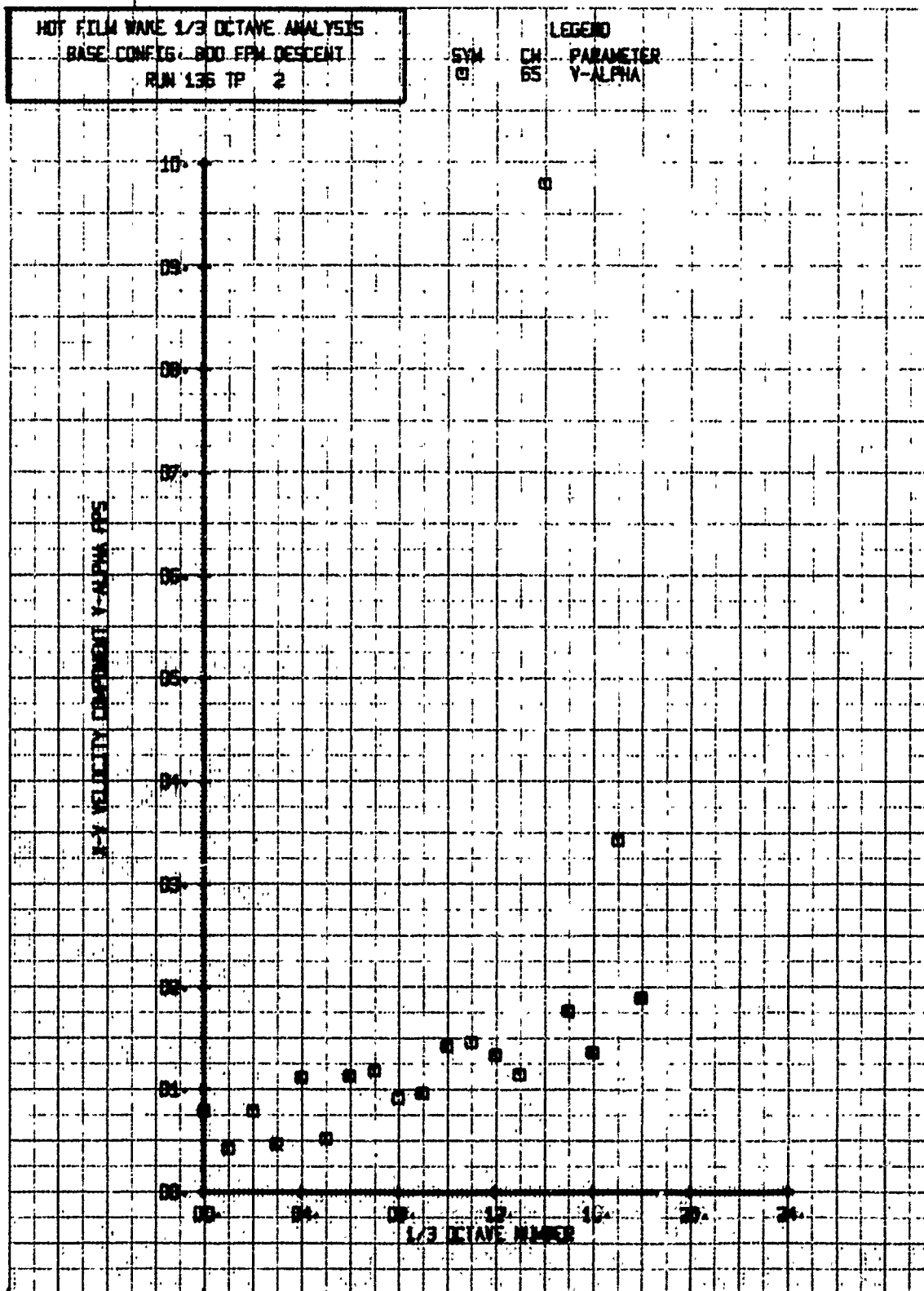
PARAMETER  
BETA

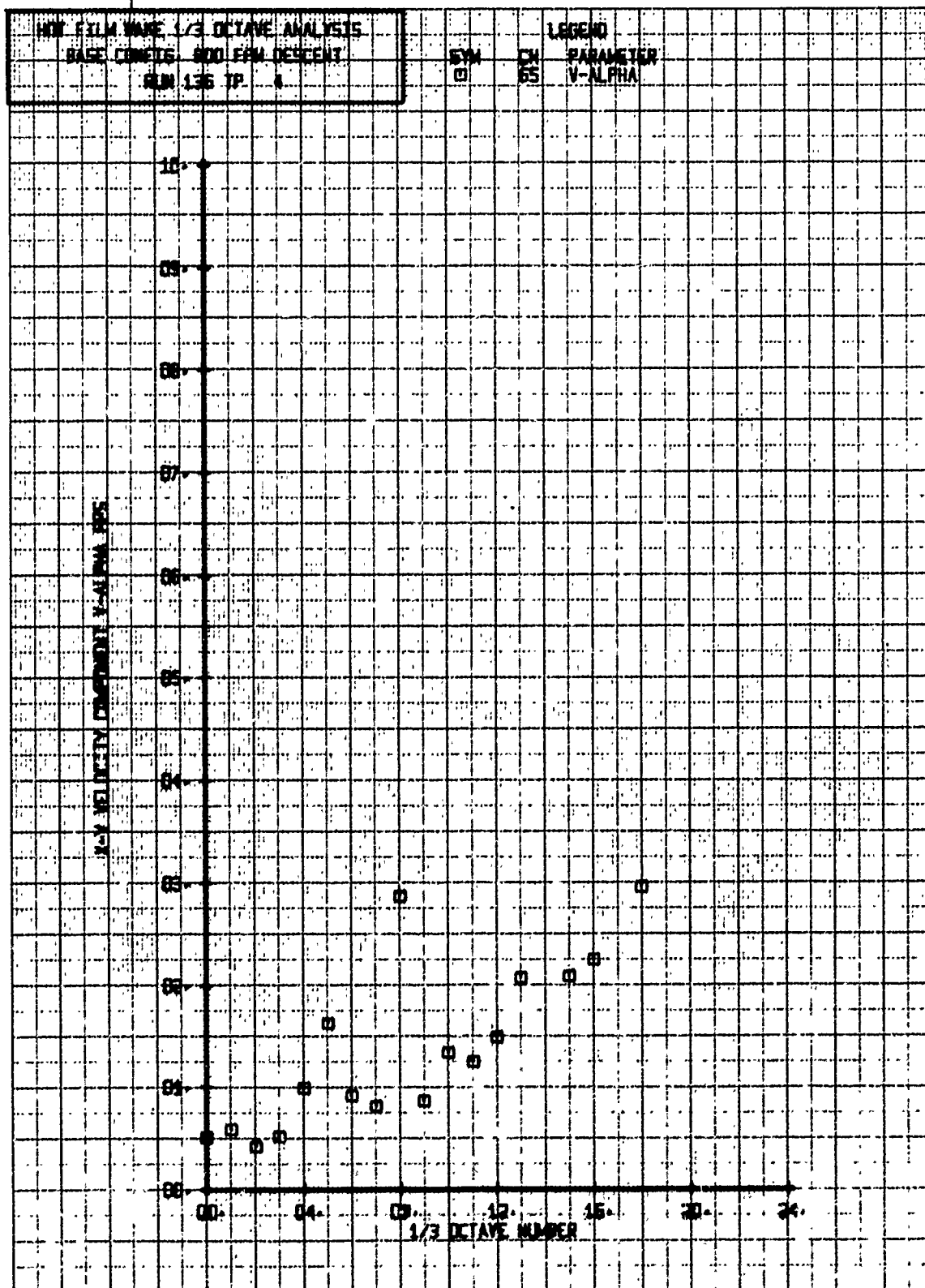
LATERAL FLOW ANGLE, BETA - DEGREES

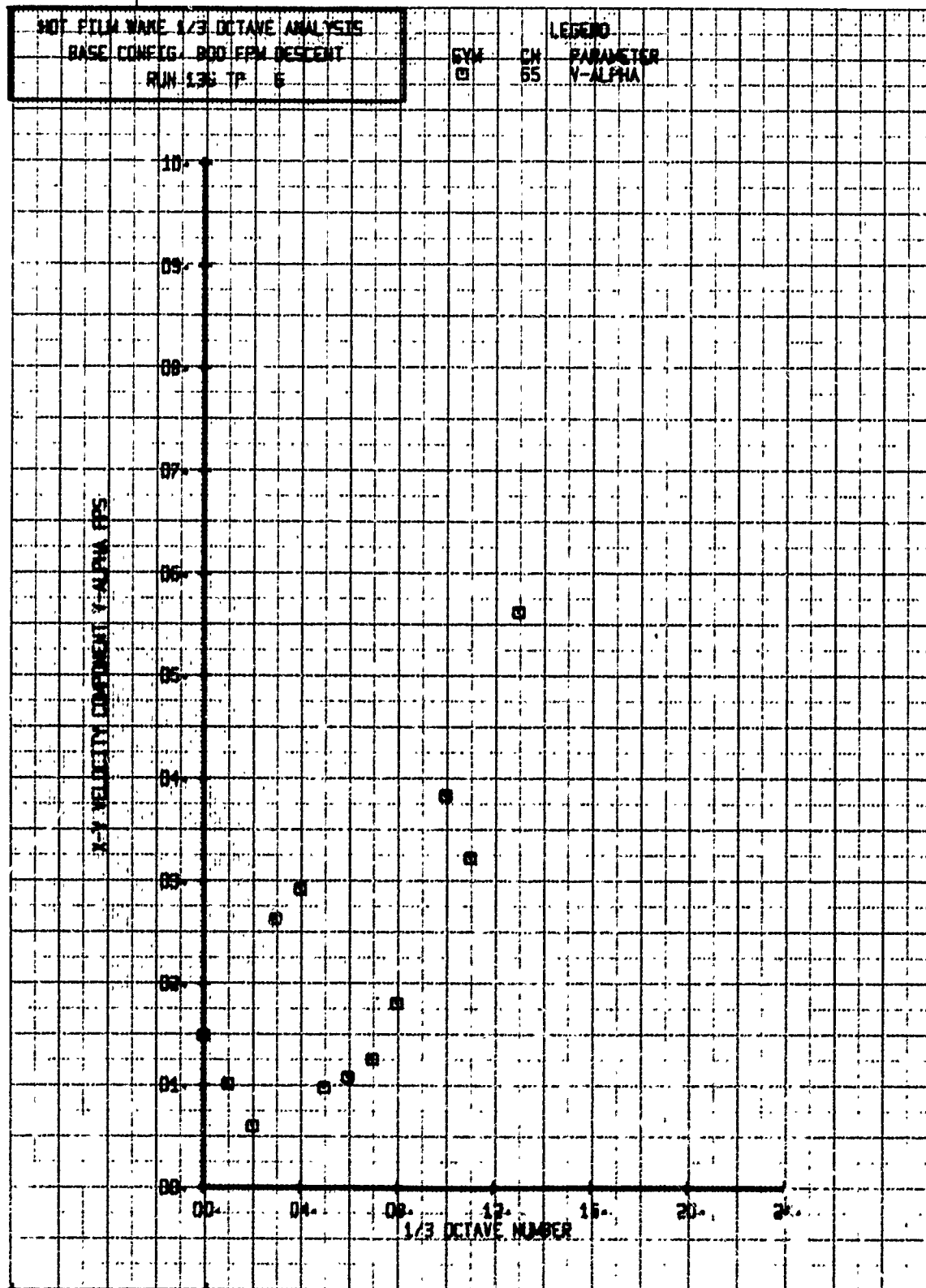


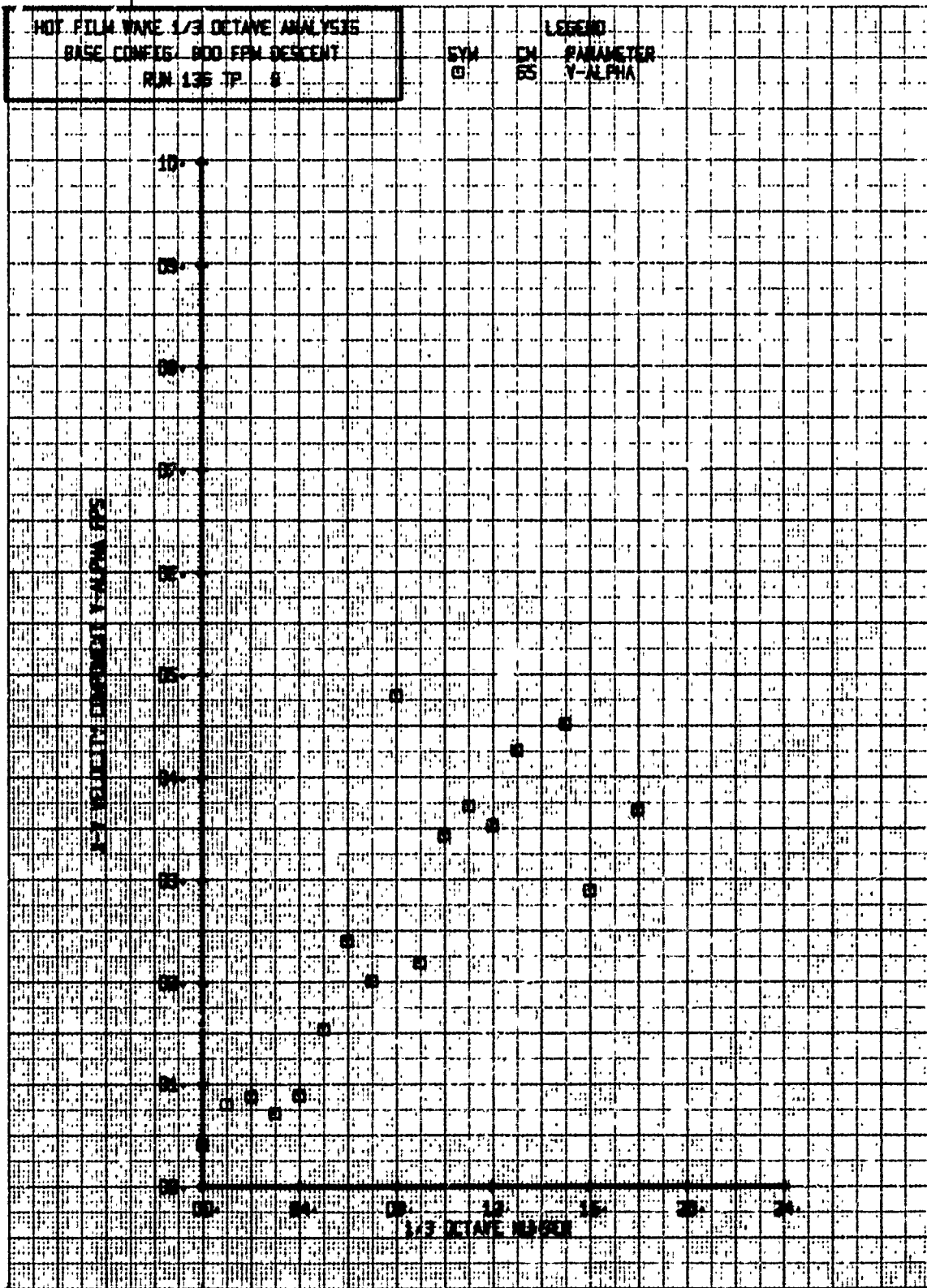




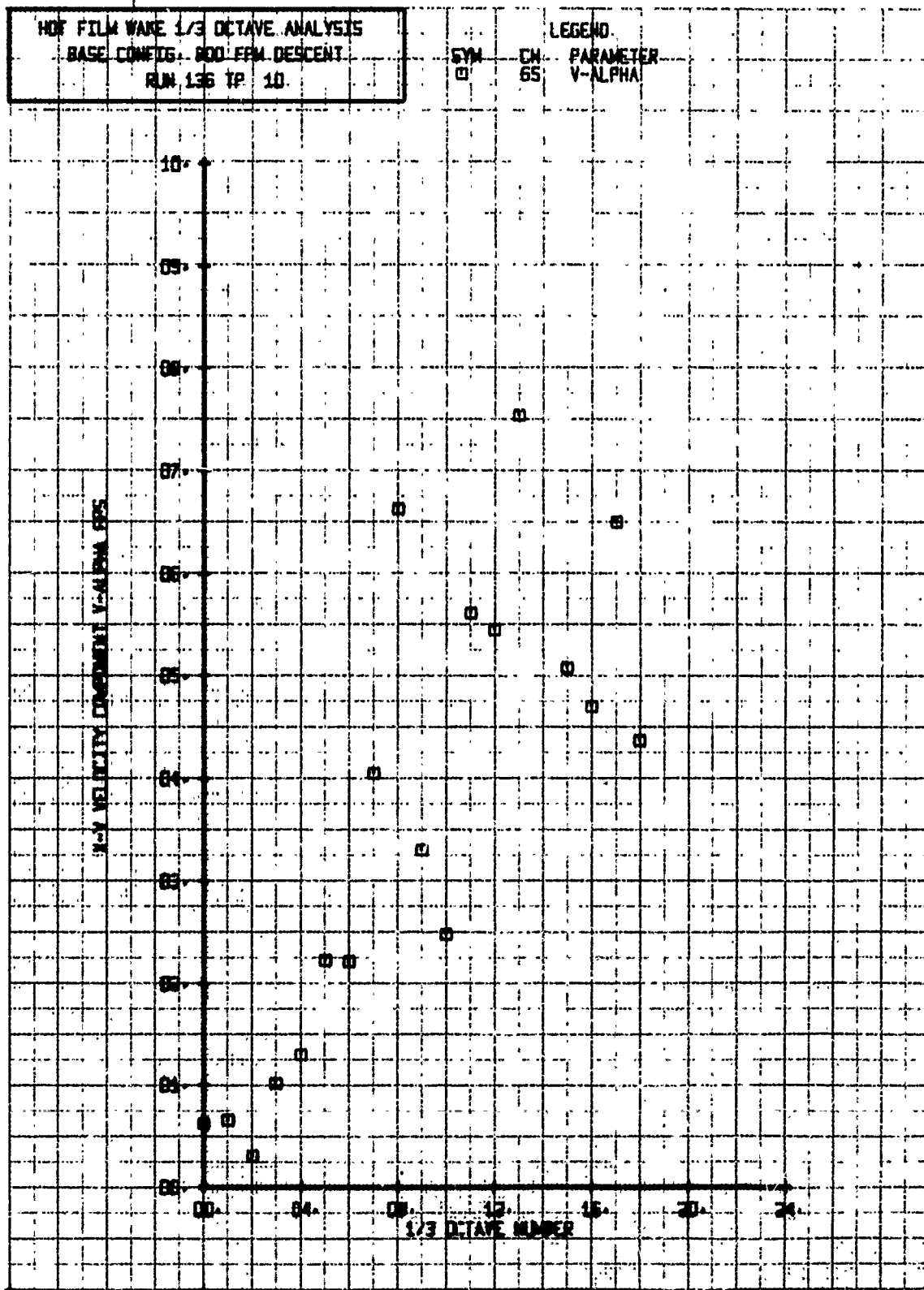


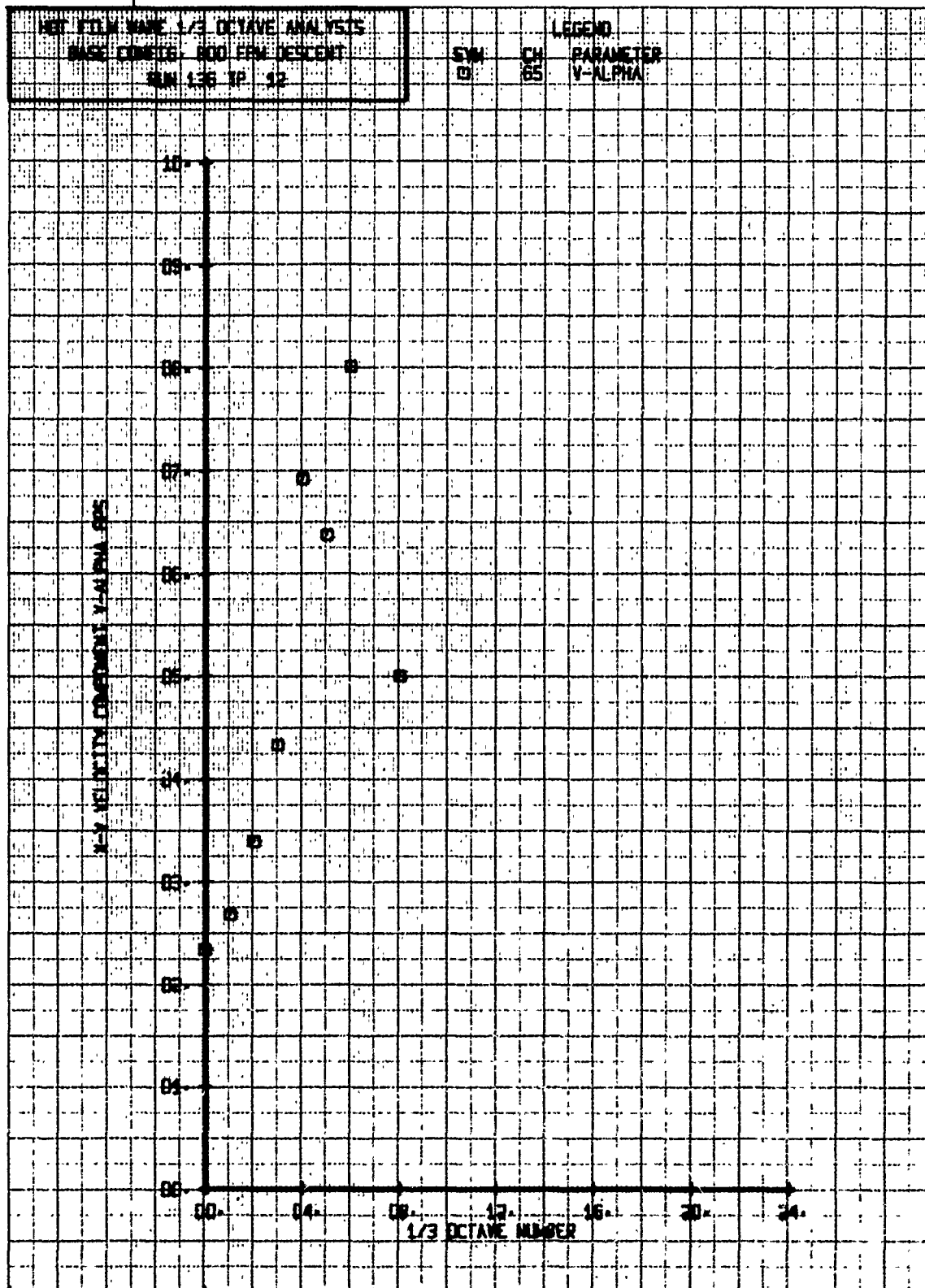








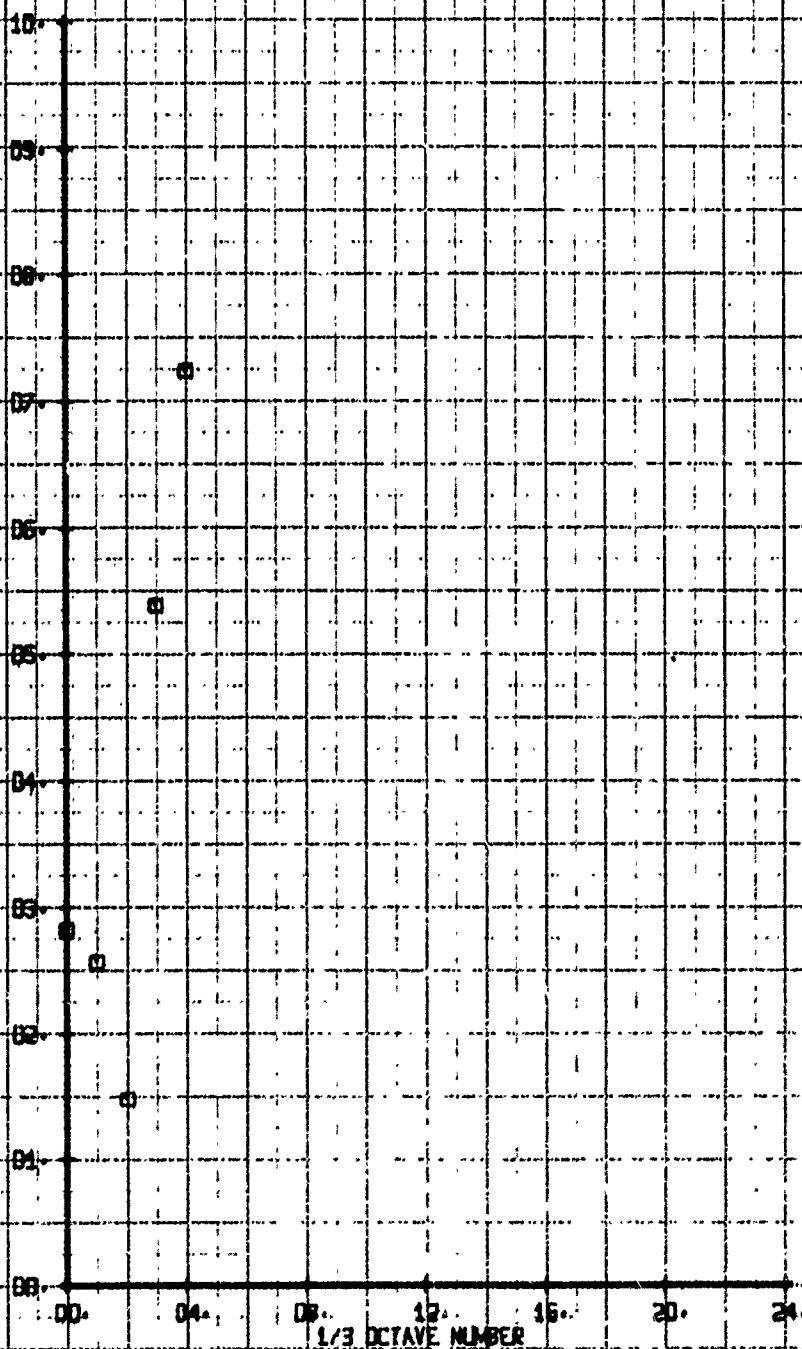


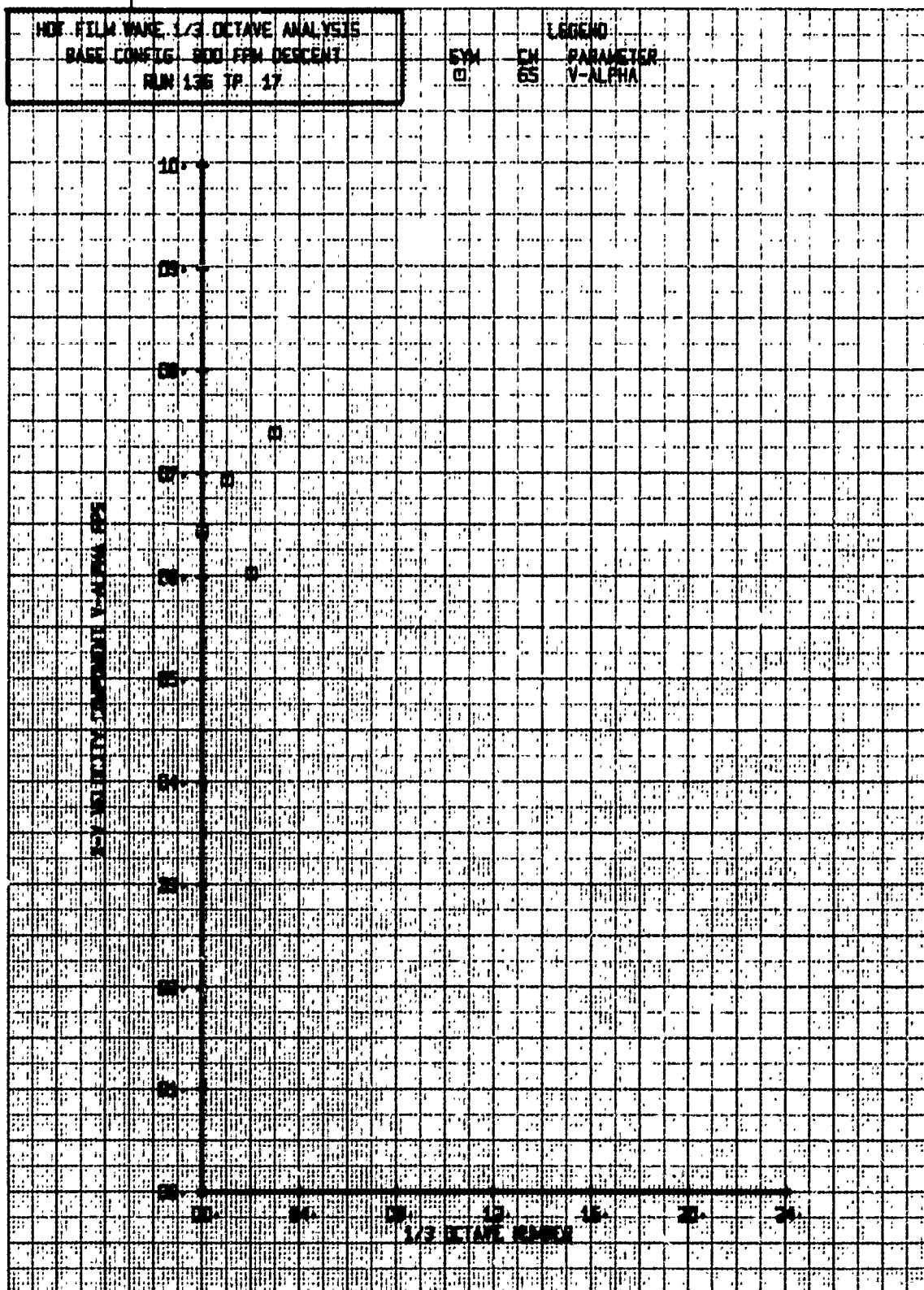


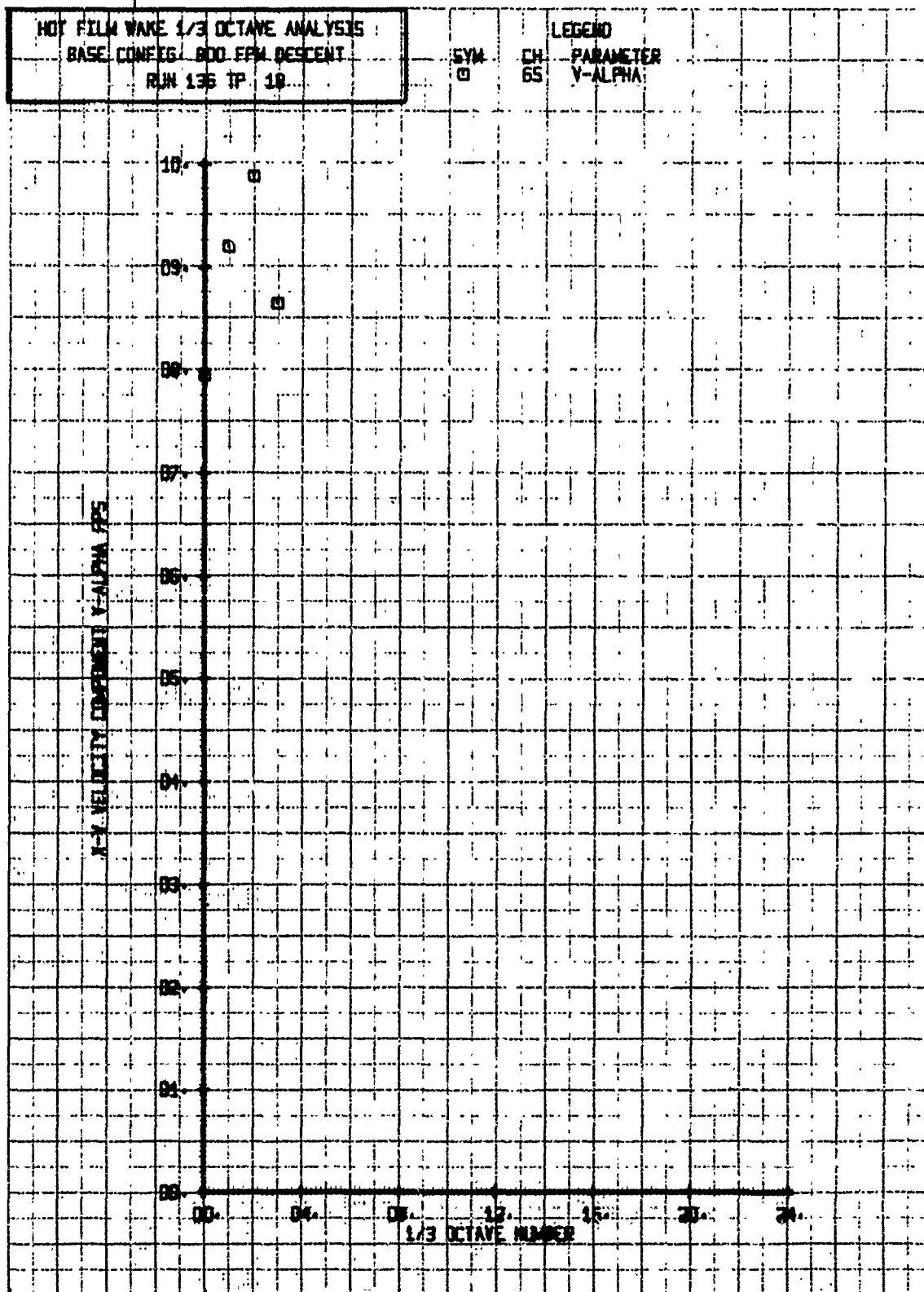
HOY FILM WAKE 1/3 OCTAVE ANALYSIS  
 BASE CONFIG 800 FPM DESCENT  
 RUN 135 TP 14

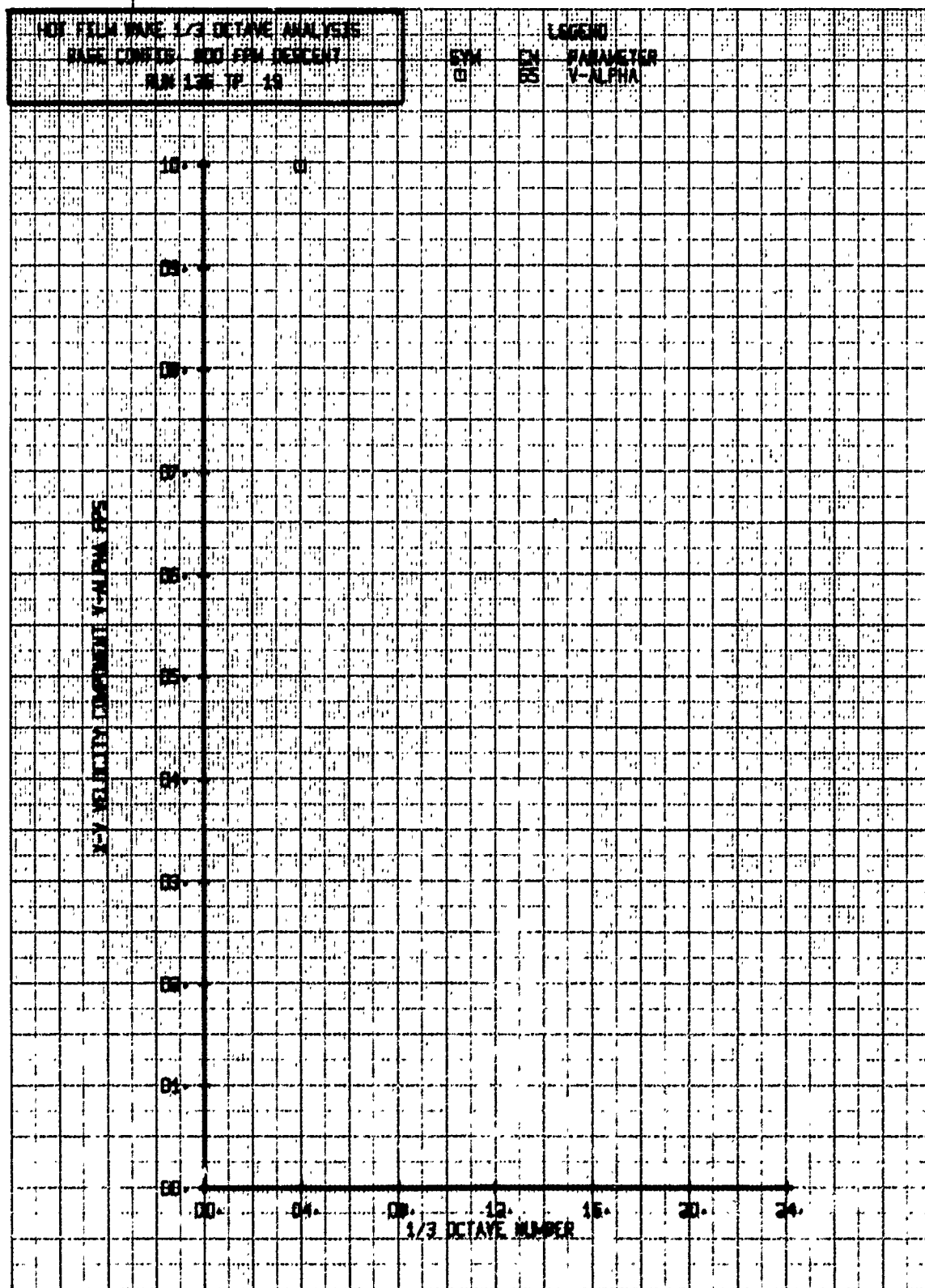
SYM CH  
 □ 65  
 LEGEND  
 PARAMETER  
 V-ALPHA

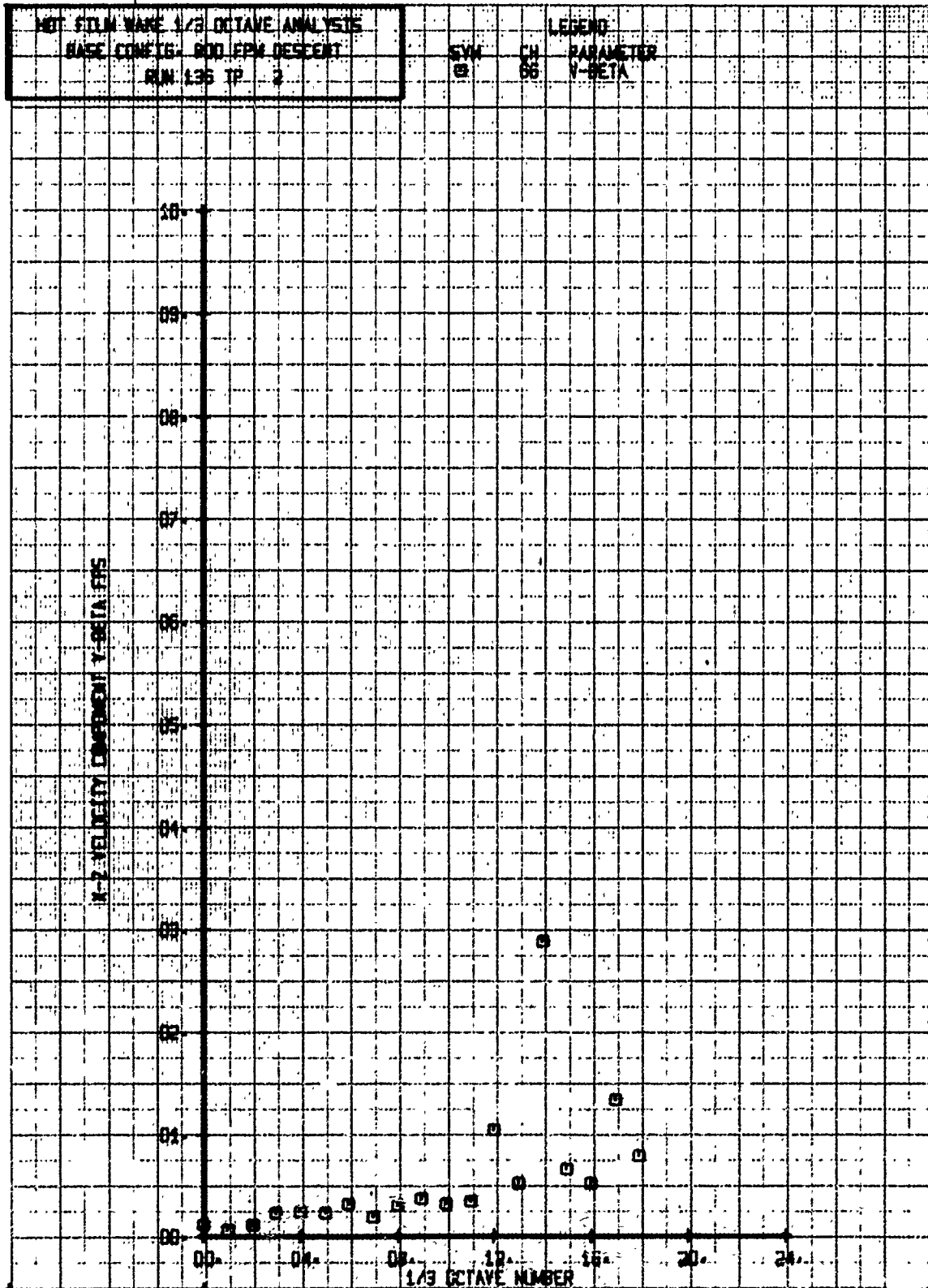
V-ALPHA (DB) VS 1/3 OCTAVE NUMBER

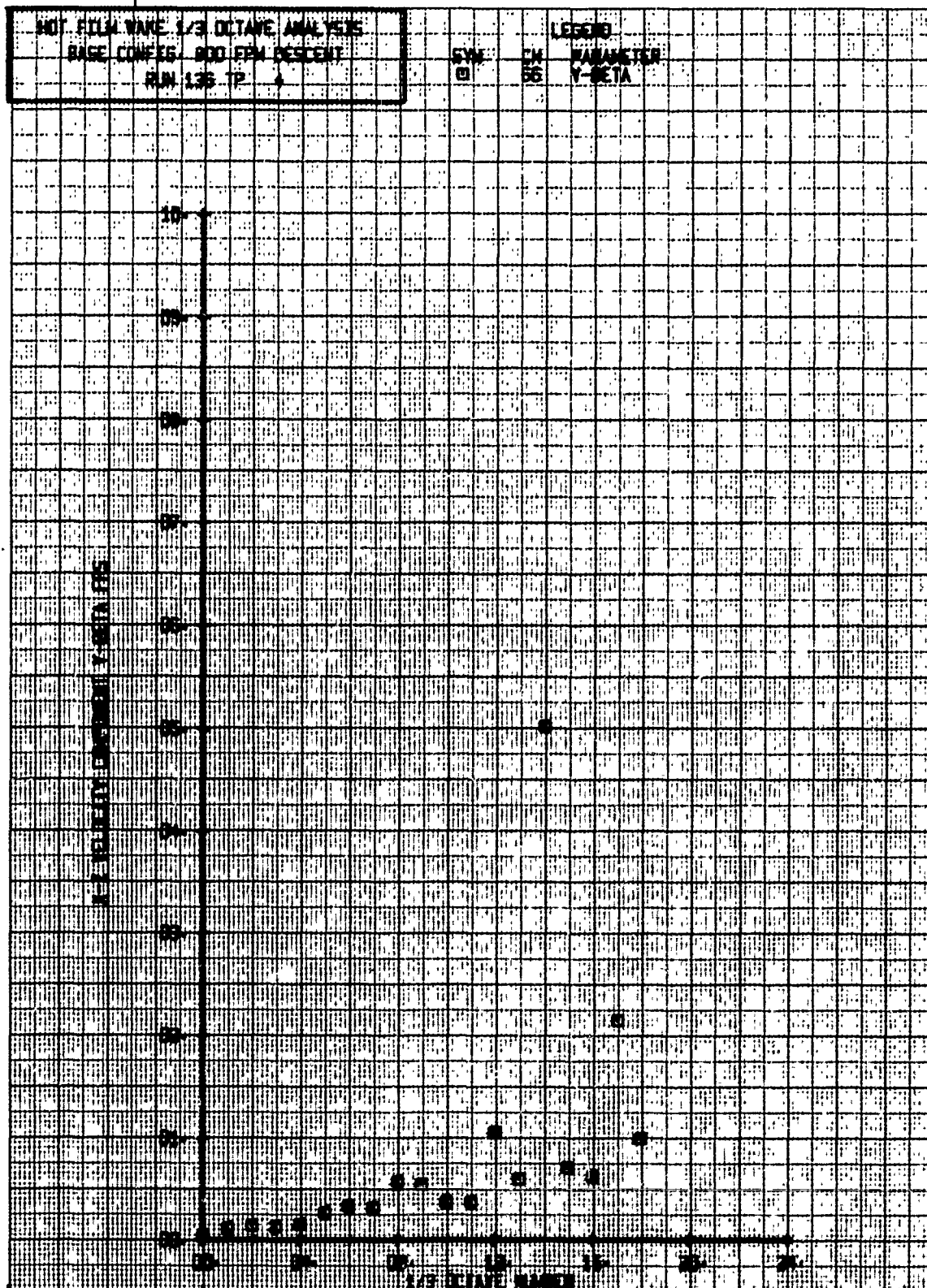




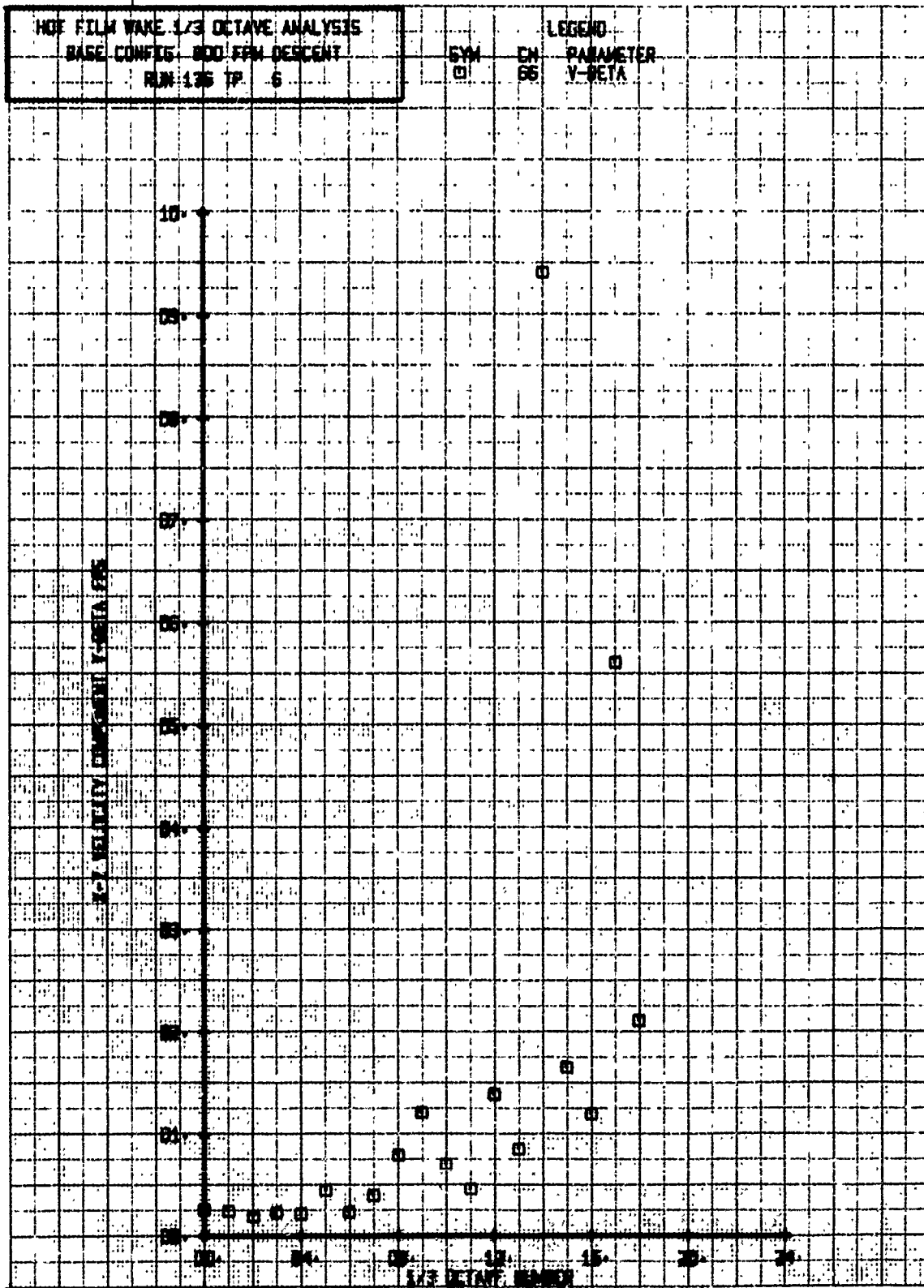








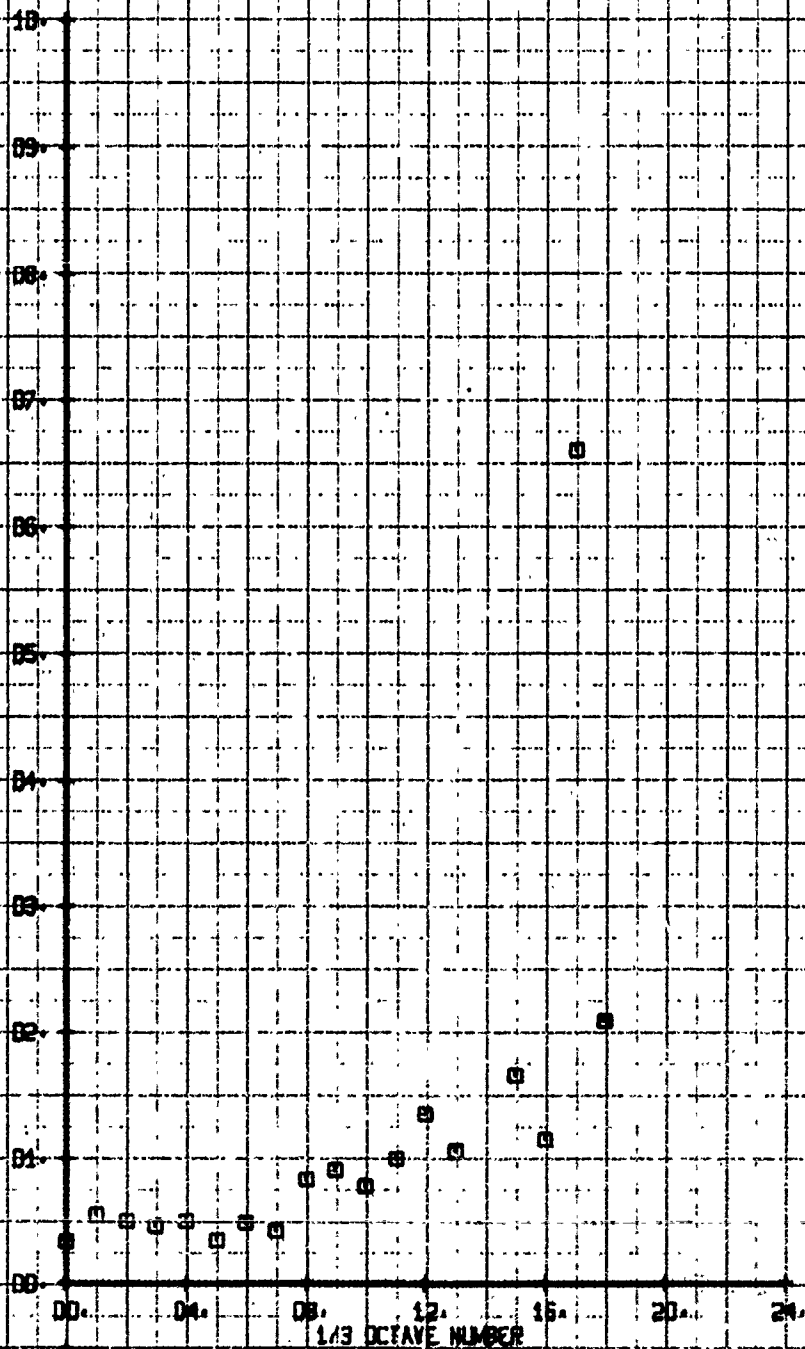


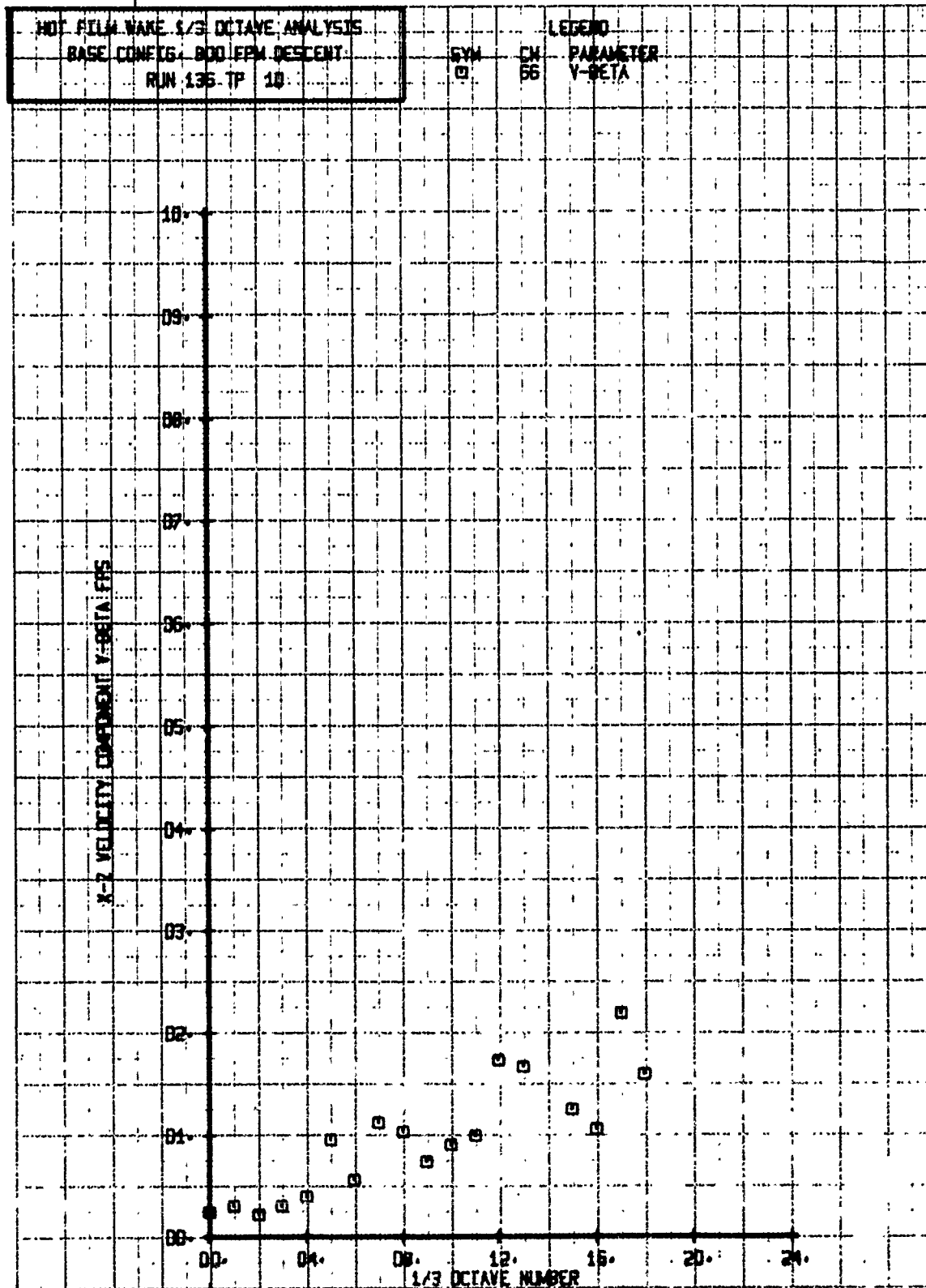


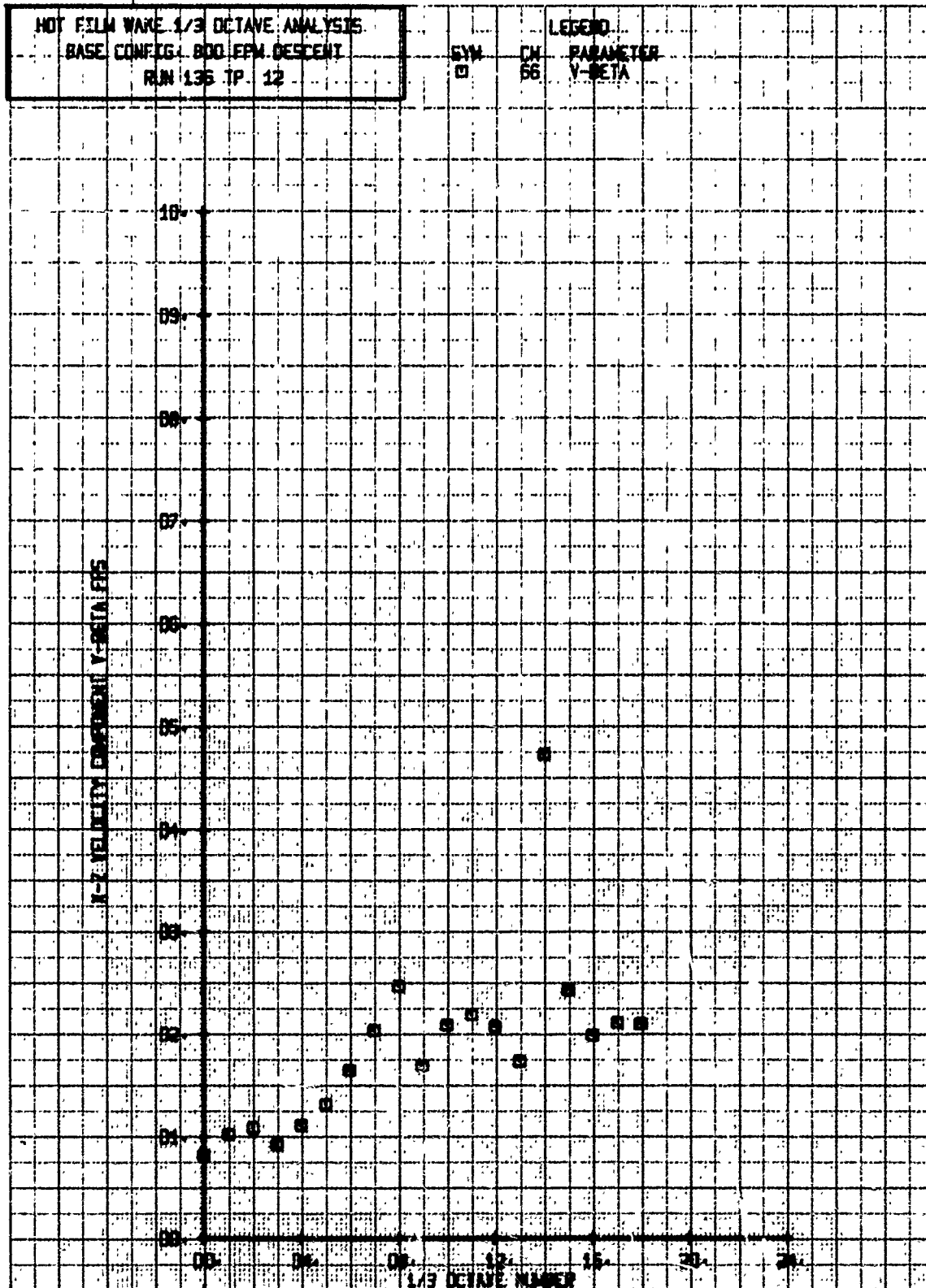
HOE FILM WAKE 1/3 OCTAVE ANALYSIS  
 BASE CONTIG 800 FPM DESCENT  
 RUN 136 TP 8

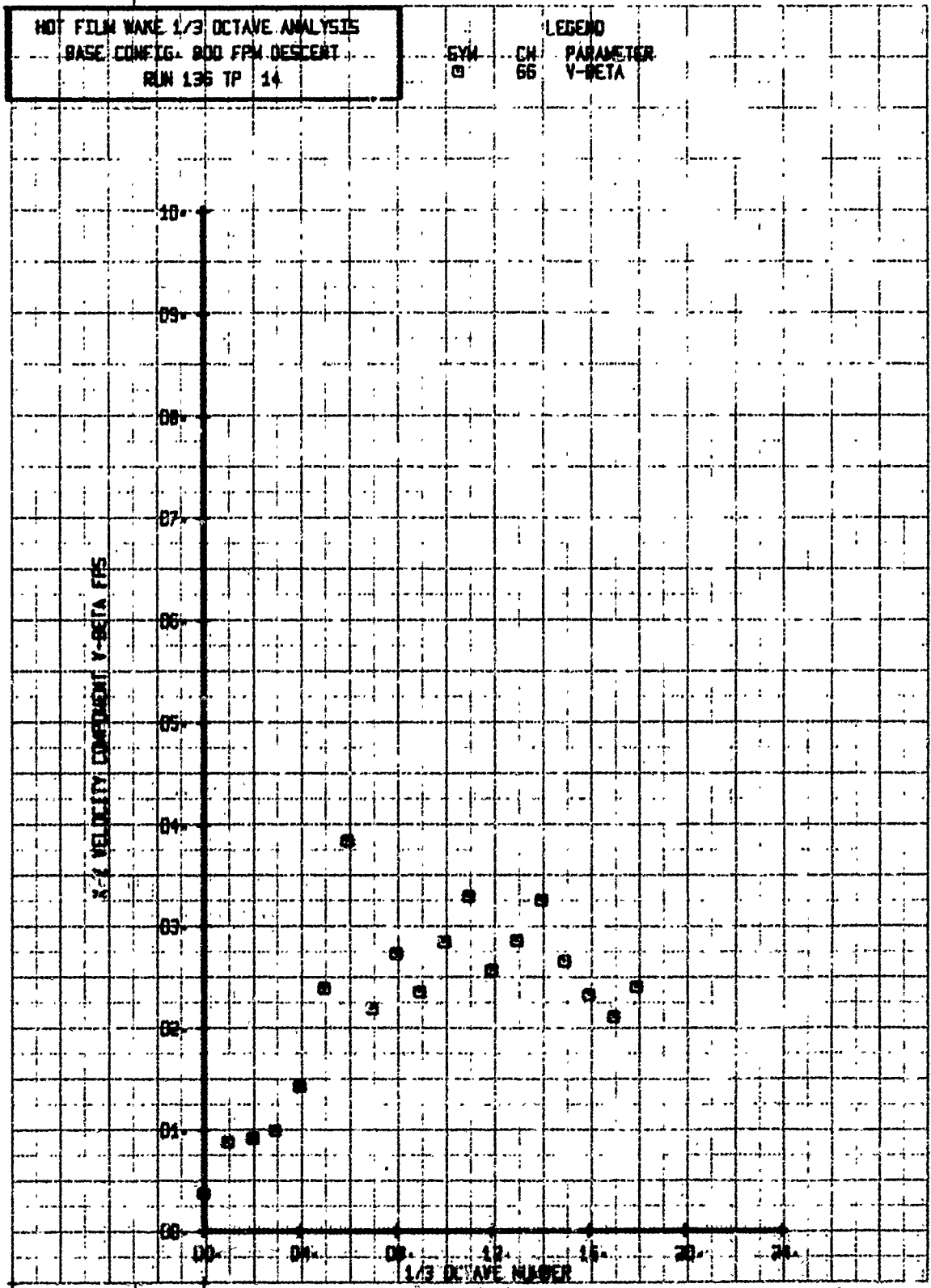
SYM CH  
 0 56  
 LEGEND  
 PARAMETER  
 Y-BETA

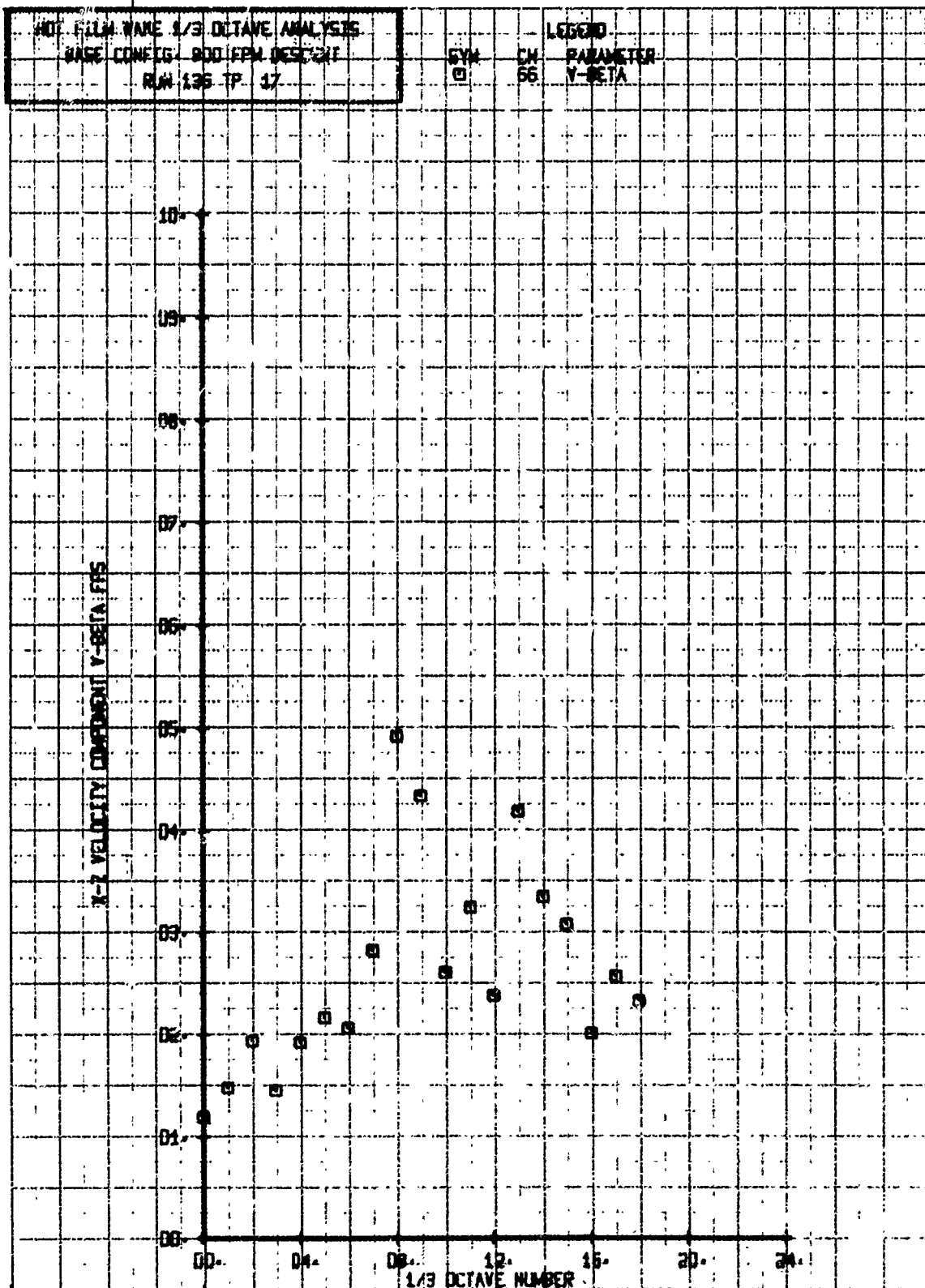
X-2 VELOCITY COMPONENT Y-BETA FRS





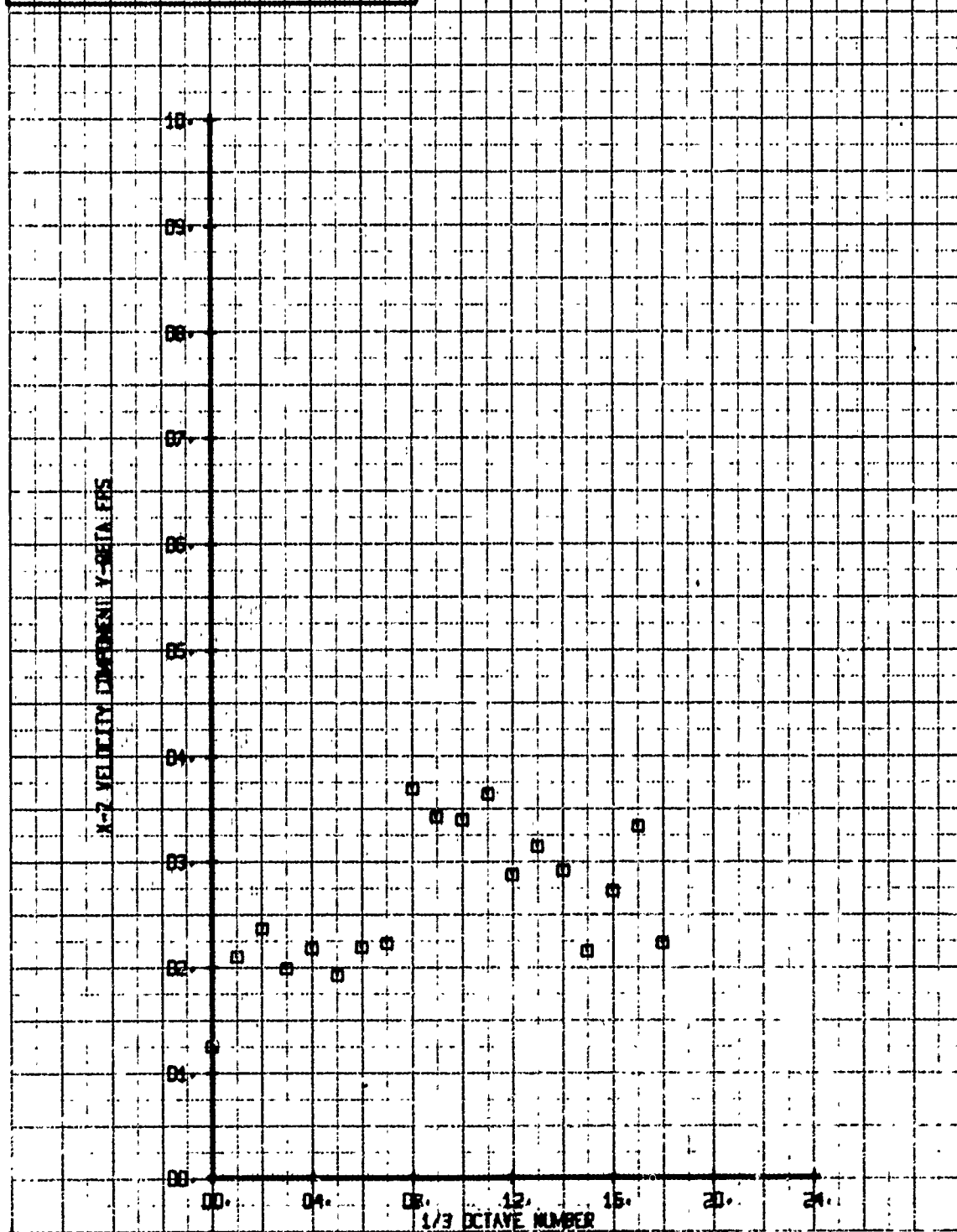






HOE FILM WAVE 1/3 OCTAVE ANALYSIS  
 BASE CONFIG: 800 FPM DESCENT  
 RUN 136 TP. 18

SYN CH  
 05 06  
 PARAMETER  
 V-BETA



# HOT FILM WAKE 1/3 OCTAVE ANALYSIS

BASE CONFIG 800 FPM DESCENT

RUN 136 TP 19

5%  
0

CH  
66

LEGEND  
PARAMETER  
V-BETA

V-BETA COMPONENT V-BETA RMS

1/3 OCTAVE NUMBER